

Open Geospatial Consortium (OGC) Moving Features

International Standardization

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International Standardization

- A technical expert of ISO TC204 (ITS), IEC SyC Smart Cities, ISO/IEC JTC1 SC42 (AI)
- The project editor of ISO/IEC AWI 5259-2. Artificial intelligence — Data quality for analytics and machine learning (ML) — Part 2: Data quality measures
- A co-chair of OGC (Open Geospatial Consortium) Moving Features SWG, GeoAI DWG

Standard

document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context

Standardization

activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context

[Source: ISO/IEC Guide 2:2004]



The Open Geospatial Consortium (OGC)

community – standards - innovation

OGC is the one place for technology, innovation, standards, community, and more. We are a neutral playing field for innovation that eliminates friction across traditionally competitive organizations. Meet your future teammates, be a leader, or become an industry partner.

OGC's member-driven consensus process creates [royalty free, publicly available, open geospatial standards](#). Existing at the cutting edge, OGC actively analyzes and anticipates emerging trends, and runs an agile Research and Development (R&D) lab – the [OGC Innovation and Collaborative Solution and Innovation Program](#) – that builds and tests innovative prototype solutions to members' use cases.



For more than 28 years, Open Geospatial Consortium (OGC) has operated as a neutral forum where government, industry, nonprofits, and academia come together to engage in collective problem-solving around the critical issues of the day. As the global leader in location solutions and related data, OGC is the largest formal community of geospatial experts with a mission to make location information FAIR – Findable, Accessible, Interoperable, and Reusable – for an inclusive and sustainable future.

230+ members from industry

120+ government agencies

185+ universities & research orgs

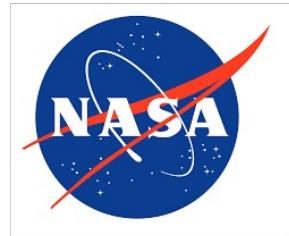
70+ standards

100+ working groups



<https://www.ogc.org/about-ogc/ogc-member-list/>

OGC Membership



AIRBUS



Hewlett Packard Enterprise

HITACHI

MAXAR



SATELLLOGIC

AIRBUS

planet.

THALES

Courtesy of Nadine Alameh (CEO, OGC)

OGC Alliance Partners

Cross-sectoral SDO collaboration activities



International Map Industry Association (IMIA)
<https://imiamaps.org/>



International Society for Photogrammetry and Remote Sensing (ISPRS)
<http://www.isprs.org/>



ISO Technical Committee 204 – Intelligent transport systems
http://www.iso.org/iso/standards_development/technical_committees/other_bodies/iso_technical_committee.htm?commid=54706



ISO IEC JTC 1/SC 24/WG 8 – Computer graphics, image processing and environmental presentation
http://www.iso.org/iso/iso_technical_committee.html?commid=45252



ISO IEC JTC 1/SC 24/WG 8 – Computer graphics, image processing and environmental presentation
http://www.iso.org/iso/iso_technical_committee.html?commid=45252



ISO Technical Committee 211 (ISO TC/211) – Geographic information/Geomatics
http://www.isotc211.org/ISO/IEC_JTC_1/WG_7 – Sensor networks
https://en.wikipedia.org/wiki/ISO/IEC_TC_1/WG_7



ISO/TC 59/SC 13 – Organization of information about construction works
http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=49180



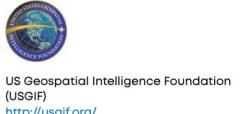
Mortgage Information Standards Maintenance Organization (MISMO)
<http://www.mismo.org/>



National Institute for Building Standards (NIBS)
<http://www.nibs.org/>



Organization for Advancement of Structured Information Standards (OASIS)
Topio Networks
<https://www.topionetworks.com/>



National States Geographic Information Council
<https://www.nsgic.org/>



<https://www.openarcloud.org/>



National Institute for Building Standards (NIBS)
<http://www.nibs.org/>



World Wide Web Consortium (W3C)
<http://www.w3.org/>



Object Management Group (OMG)
<http://www.omg.org/>



Open Grid Forum (OGF)
<http://www.ogf.org/>



Open Source Geospatial Foundation (OSGeo)
<http://www.osgeo.org/>



WMO-OGC Memorandum of Understanding, 23 November 2009

IETF
Internet Engineering Task Force (IETF)
<http://www.ietf.org/>

OGC Working Groups

• Domain Working Group (DWG)

- To provide a forum for discussion of key interoperability requirements and issues, discussion and review of implementation specifications, and presentations on key technology areas relevant to solving geospatial interoperability issues.
- Agriculture, Big Data, Earth Observation Exploitation Platform, etc.
- <https://www.ogc.org/about-ogc/committees/dwg/>

• Standard Working Group (SWG)

- To be working on a candidate standard prior to approval as an OGC standard or on making revisions to an existing OGC standard.
- Coverage, CRS, GeoTIFF, etc.
- <https://www.ogc.org/about-ogc/committees/swg/>

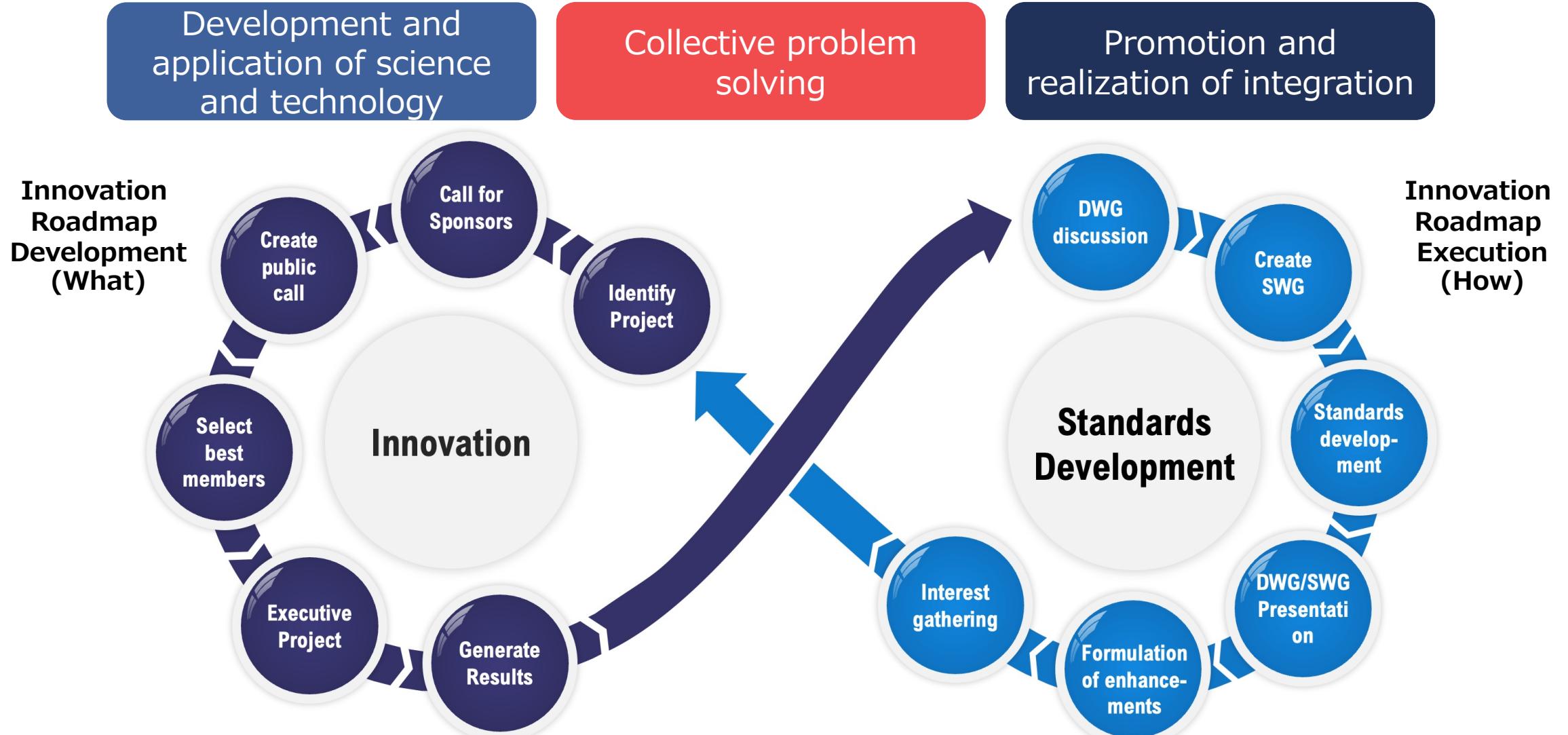
[3D Information Management DWG \(3DIM DWG\)](#)
[Agriculture DWG \(Agriculture DWG\)](#)
[Architecture DWG \(Arch DWG\)](#)
[Artificial Intelligence in Geoinformatics DWG \(GeoAI DWG\)](#)
[Aviation DWG \(Aviation DWG\)](#)
[Big Data DWG \(BigData DWG\)](#)
[Blockchain and Distributed Ledger Technologies DWG \(BDLT DWG\)](#)
[Citizen Science DWG \(Citizen Science\)](#)
[Coordinate Reference System DWG \(CRS DWG\)](#)
[Coverages DWG \(Coverages DWG\)](#)
[Data Preservation DWG \(PreservDWG\)](#)
[Data Quality DWG \(DQ DWG\)](#)
[Defense and Intelligence DWG \(D and I DWG\)](#)
[Discrete Global Grid Systems DWG \(DGGS DWG\)](#)
[Earth Observation Exploitation Platform DWG \(EO Ex Platform\)](#)
[Earth Systems Science DWG \(ESS DWG\)](#)
[Emergency and Disaster Management DWG \(EDM DWG\)](#)
[Energy and Utilities DWG \(EnergyUtilities\)](#)
[Geography Markup Language \(GML\) DWG \(GML DWG\)](#)
[Geoscience DWG \(Geoscience DWG\)](#)
[Geosemantics DWG \(Semantics\)](#)

[Health DWG \(Health DWG\)](#)
[Hydrology DWG \(Hydrology DWG\)](#)
[Interoperable Simulation and Gaming DWG \(ISG DWG\)](#)
[Land Administration DWG \(LandAdmin\)](#)
[Land and Infrastructure DWG \(LandInfraDWG\)](#)
[Marine DWG \(Marine DWG\)](#)
[Metadata and Catalog DWG \(MetaCat DWG\)](#)
[Meteorology & Oceanography DWG \(Met Ocean DWG\)](#)
[Mobile Location Services DWG \(MLSDWG\)](#)
[Perspective Imagery DWG \(PerspectImageryD\)](#)
[Point Cloud DWG \(Point Cloud DWG\)](#)
[Portrayal DWG \(Portrayal DWG\)](#)
[Quality of Service and Experience DWG \(QoSE DWG\)](#)
[Security DWG \(SecurityDWG\)](#)
[Sensor Web Enablement DWG \(SensorWeb DWG\)](#)
[Smart Cities DWG \(SmartCities DWG\)](#)
[Statistical DWG \(Statistical DWG\)](#)
[Temporal DWG \(Temporal DWG\)](#)
[Uninhabited Systems \(UxS\) DWG \(UxS DWG\)](#)
[University DWG \(Univ DWG\)](#)
[Workflow DWG \(Workflow DWG\)](#)

[3D GeoVolumes SWG \(3DGeoVol SWG\)](#)
[3D Portrayal SWG \(3DP SWG\)](#)
[CDB SWG \(CDB SWG\)](#)
[CityGML SWG \(CityGML SWG\)](#)
[Coverages SWG \(CoveragesSWG\)](#)
[CRS SWG \(CRS SWG\)](#)
[CRS Well Known Text SWG \(CRS WKT SWG\)](#)
[Discrete Global Grid Systems SWG \(DGGS SWG\)](#)
[Environmental Data Retrieval API SWG \(EDR-API SWG\)](#)
[EO Product Metadata and OpenSearch SWG \(EO PMOS SWG\)](#)
[Features and Geometries JSON SWG \(FeatGeoJSON SWG\)](#)
[Features API SWG \(FeatAPI SWG\)](#)
[GeoAPI SWG \(GeoAPI SWG\)](#)
[Geocoding API SWG \(GeocodeAPISWG\)](#)
[GeoPackage SWG \(GeoPackage SWG\)](#)
[GeoPose SWG \(GeoPose SWG\)](#)
[GeoSciML SWG \(GeoSciML SWG\)](#)
[GeoSPARQL SWG \(GeoSPARQL SWG\)](#)
[Geospatial User Feedback SWG \(GUFSwga\)](#)
[GeoSyncrhonization 1.0 SWG \(Geosync SWG\)](#)
[GeoTIFF SWG \(GeoTIFF SWG\)](#)
[GeoXACML SWG \(GeoXACML SWG\)](#)
[GML 3.3 SWG \(GML 3.3 SWG\)](#)
[GMLJP2 SWG \(GMLJP2-SWG\)](#)
[Groundwater SWG \(GroundwaterSWG\)](#)
[HDF SWG \(HDF SWG\)](#)
[Hydrologic Features SWG \(HydroFeat SWG\)](#)

[IndoorGML SWG \(IndoorGML SWG\)](#)
[KML 2.3 SWG \(KML SWG\)](#)
[Land and Infrastructure SWG \(LandInfraSWG\)](#)
[Moving Features SWG \(MovFeat SWG\)](#)
[MUDDI SWG \(MUDDI SWG\)](#)
[NetCDF SWG \(NetCDFSWG\)](#)
[O&M SWG \(OM SWG\)](#)
[OGC API - Common SWG \(OGC API-Common\)](#)
[OGC API - Maps SWG \(OGC API - Maps\)](#)
[OGC API - Processes SWG \(OAPIProc SWG\)](#)
[OGC API - Records SWG \(API Records SWG\)](#)
[OGC API - Styles SWG \(Styles API SWG\)](#)
[OGC API - Tiles SWG \(OAPITileSWG\)](#)
[OWS Common - Security SWG \(ComSecuritySWG\)](#)
[OWS Context SWG \(OWScontextSWG\)](#)
[PipelineML SWG \(PipeML SWG\)](#)
[Points of Interest SWG \(Pol SWG\)](#)
[PubSub SWG \(PubSub SWG\)](#)
[Routing SWG \(Routing SWG\)](#)
[Sensor Model Language \(SensorML\) 2.0 SWG \(SensorML2.0SWG\)](#)
[SensorThings SWG \(SensorThings\)](#)
[Simple Features SWG \(SF SWG\)](#)
[Styles and Symbology Encoding SWG \(Styles SE SWG\)](#)
[Temporal WKT for Calendars SWG \(TemporalWKT\)](#)
[TimeSeriesML SWG \(TimeSeriesML\)](#)
[Training Data Markup Language for AI SWG \(TrainingDML SWG\)](#)
[WaterML 2.0 SWG \(WaterML2.0SWG\)](#)

OGC Innovation Continuum



[SOURCE] https://portal.ogc.org/files/?artifact_id=92756

OGC Innovation Projects

We solve problems - together



100+

Completed Projects

25+

Active Initiatives

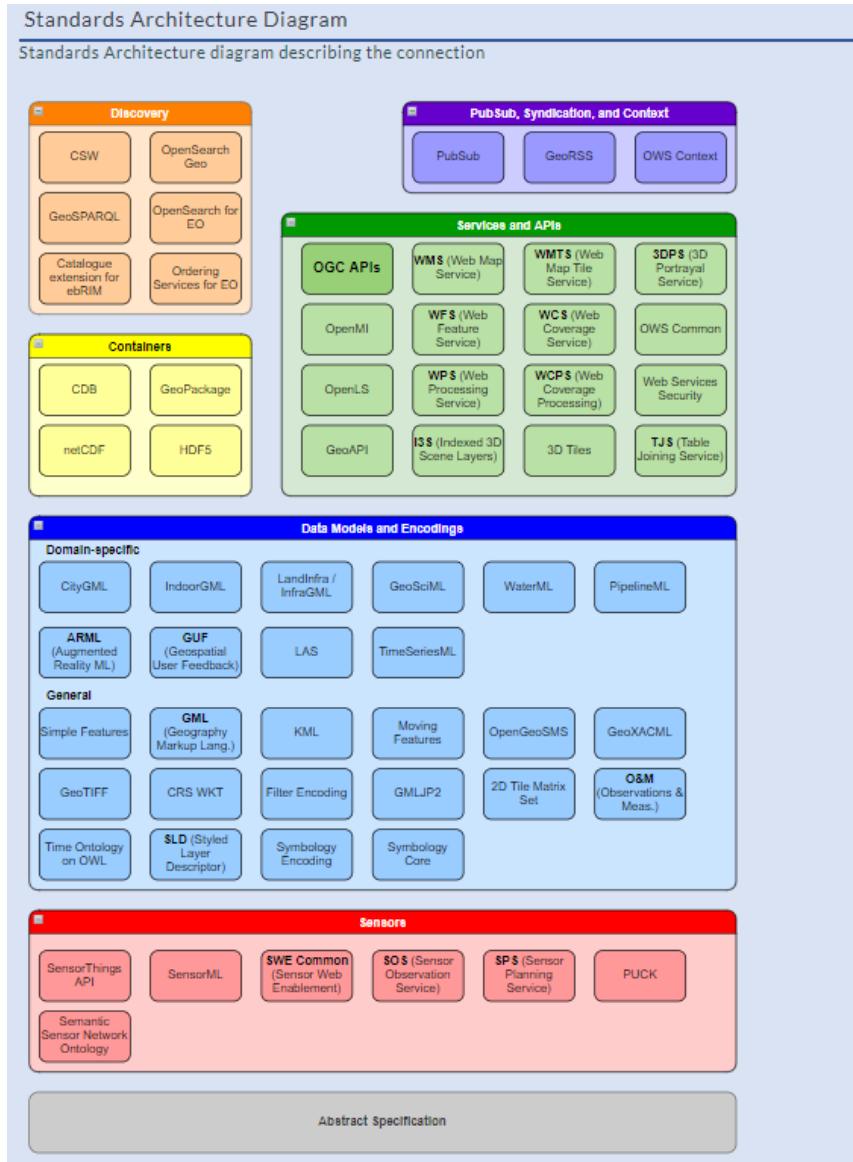
1.8M

Redistributed to OGC members

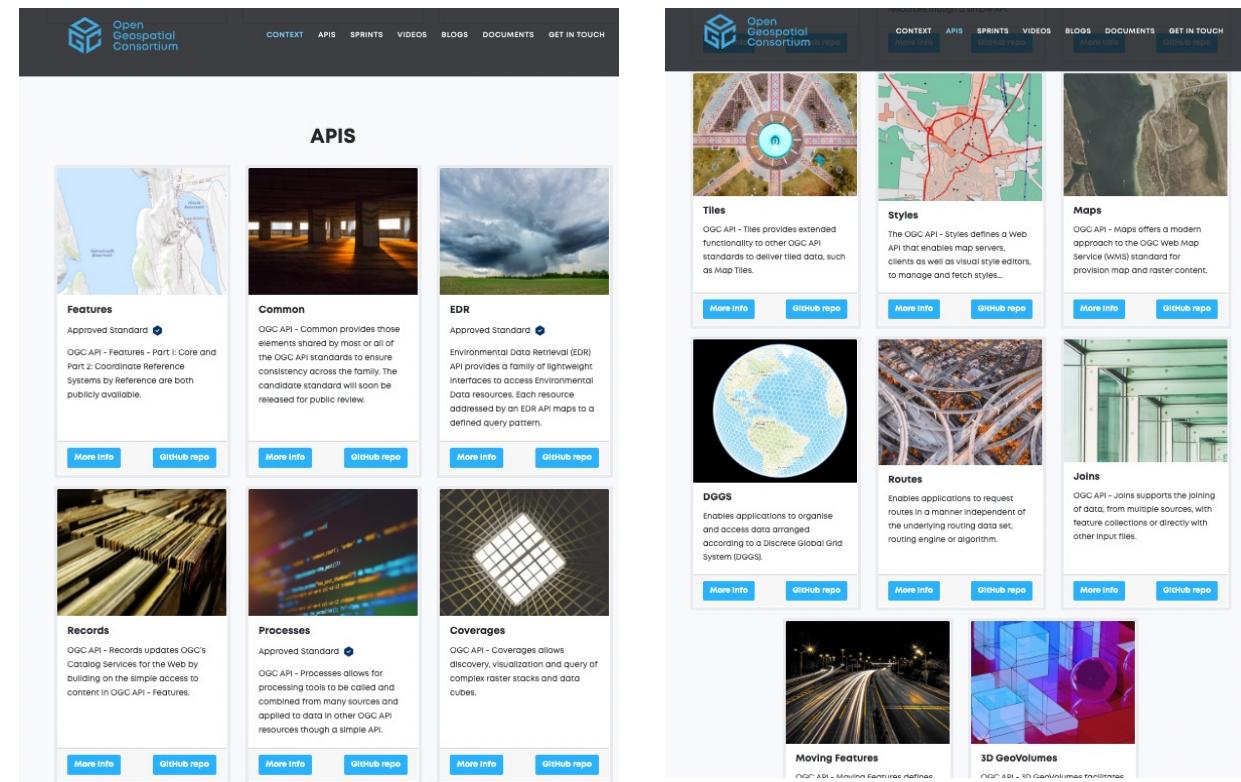
OGC Brings together the experts and the resources for collective problem solving

Courtesy of Nadine Alameh (CEO, OGC)

Digital Twins – standards to connect silos



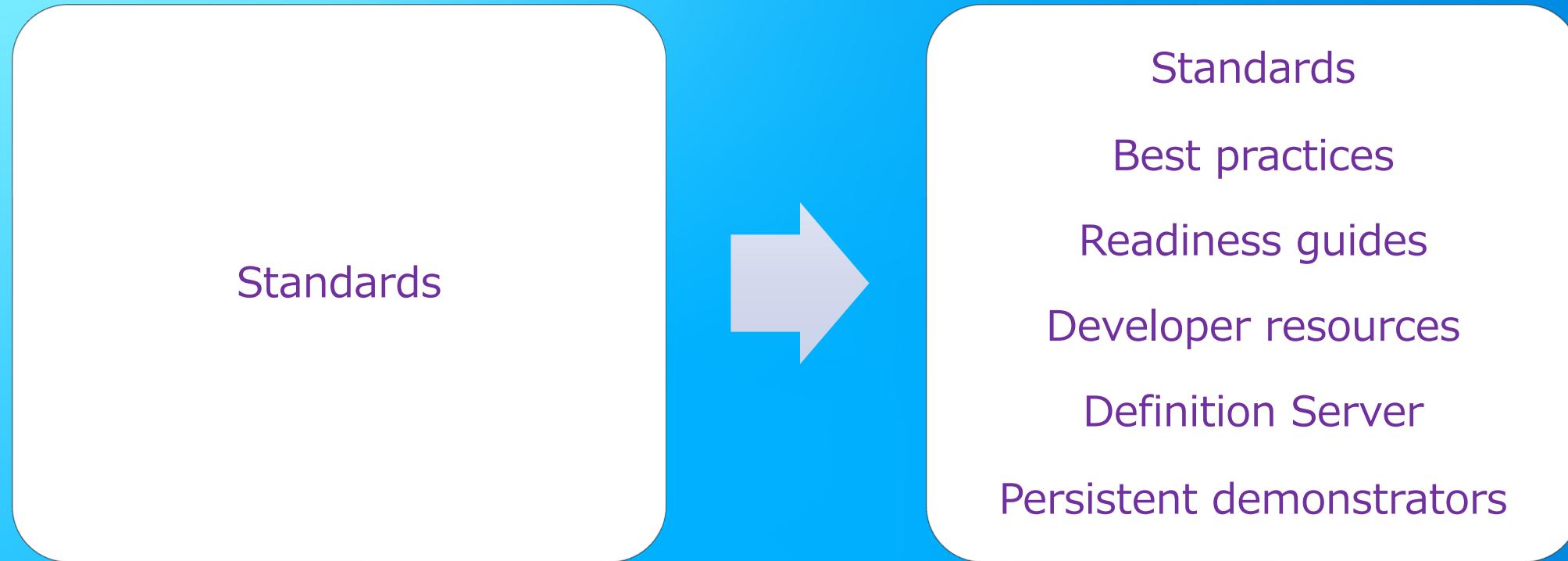
<https://ogcapi.ogc.org/>



The OGC APIs homepage features a navigation bar with links to CONTEXT, APIs, SPRINTS, VIDEOS, BLOGS, DOCUMENTS, and GET IN TOUCH. The main content area is divided into several sections:

- APIS:** A grid of thumbnail images representing different API categories.
- Tiles:** OGC API - Tiles provides extended functionality to other OGC API standards to deliver tiled data, such as Map Tiles.
- Styles:** The OGC API - Styles defines a web API that enables map servers, clients as well as visual style editors, to manage and fetch styles..
- Maps:** OGC API - Maps offers a modern approach to the OGC Web Map Service (WMS) standard for provision map and raster content.
- Features:** Approved Standard. OGC API - Features - Part 1: Core and Part 2: Coordinate Reference Systems by Reference are both publicly available.
- Common:** OGC API - Common provides those elements shared by most or all of the OGC API standards to ensure consistency across the family. The candidate standard will soon be released for public review.
- EDR:** Approved Standard. Environmental Data Retrieval (EDR) API provides a family of lightweight interfaces to access environmental data resources. Each resource addressed by an EDR API maps to a defined query pattern.
- Records:** OGC API - Records updates OGC's Catalog Services for the Web by building on the simple access to content in OGC API - Features.
- Processes:** Approved Standard. OGC API - Processes allows for processing tools to be called and combined from many sources and applied to data in other OGC API resources through a simple API.
- Coverages:** OGC API - Coverages allows discovery, visualization and query of complex raster stacks and data cubes.
- DGGS:** Enables applications to organize and access data arranged according to a Discrete Global Grid System (DGGS).
- Routes:** Enables applications to request routes in a manner independent of the underlying routing data set, routing engine or algorithm.
- Moving Features:** OGC API - Moving Features defines 3D GeoVolumes.
- 3D GeoVolumes:** OGC API - 3D GeoVolumes facilitates

Courtesy of Nadine Alameh (OGC)

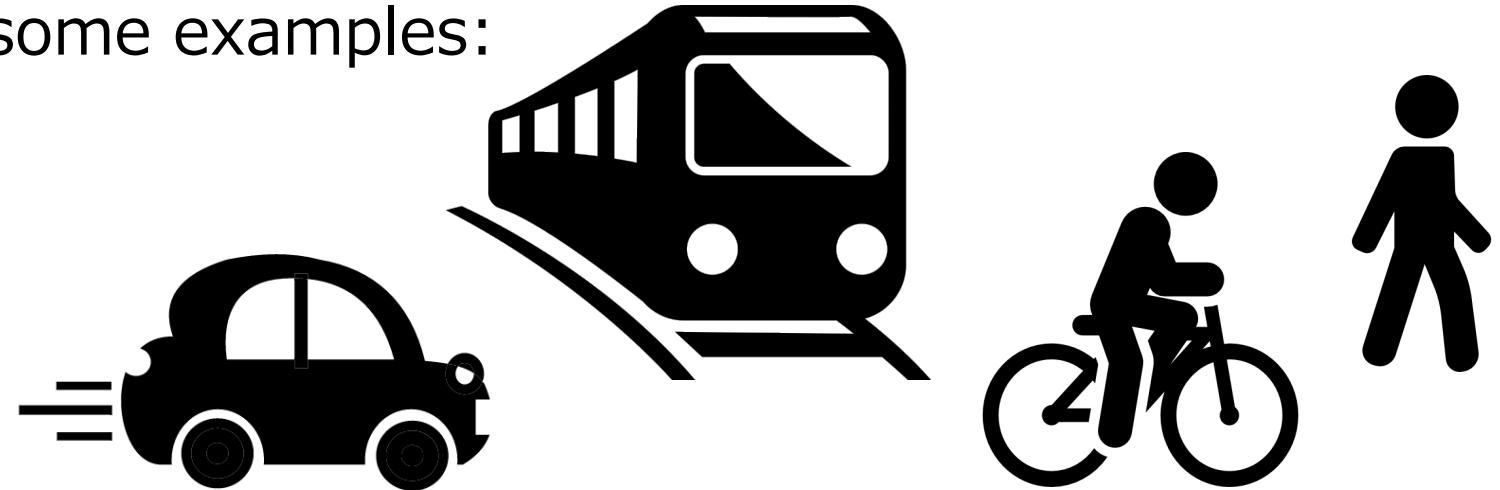


OGC delivers to the world a WEALTH of knowledge that goes way beyond the standards we're known for!

Various types of moving features in the real world

- **Moving Feature:** feature whose **location changes over time**
- We can easily imagine some examples:

- Cars,
- Trains,
- Bicycles,
- Pedestrians,
- ...



- Their **positions** changed over time, and they are usually represented by **Points**
 - How about its **shape**? With other representations, such as Curve, Surface, ...
 - How about its **properties**? Such as speeds, directions, capacities, ...

Various representations with moving features

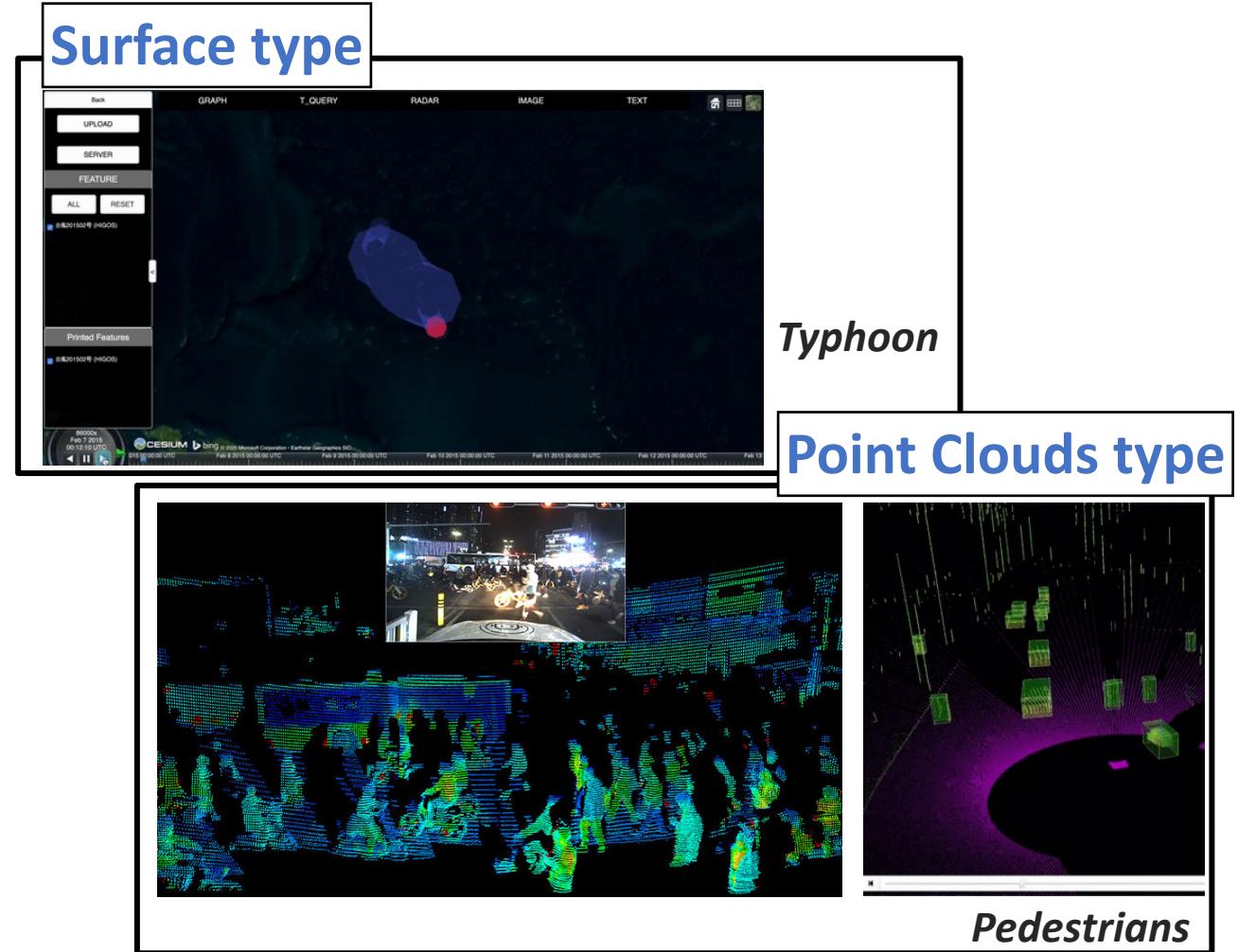
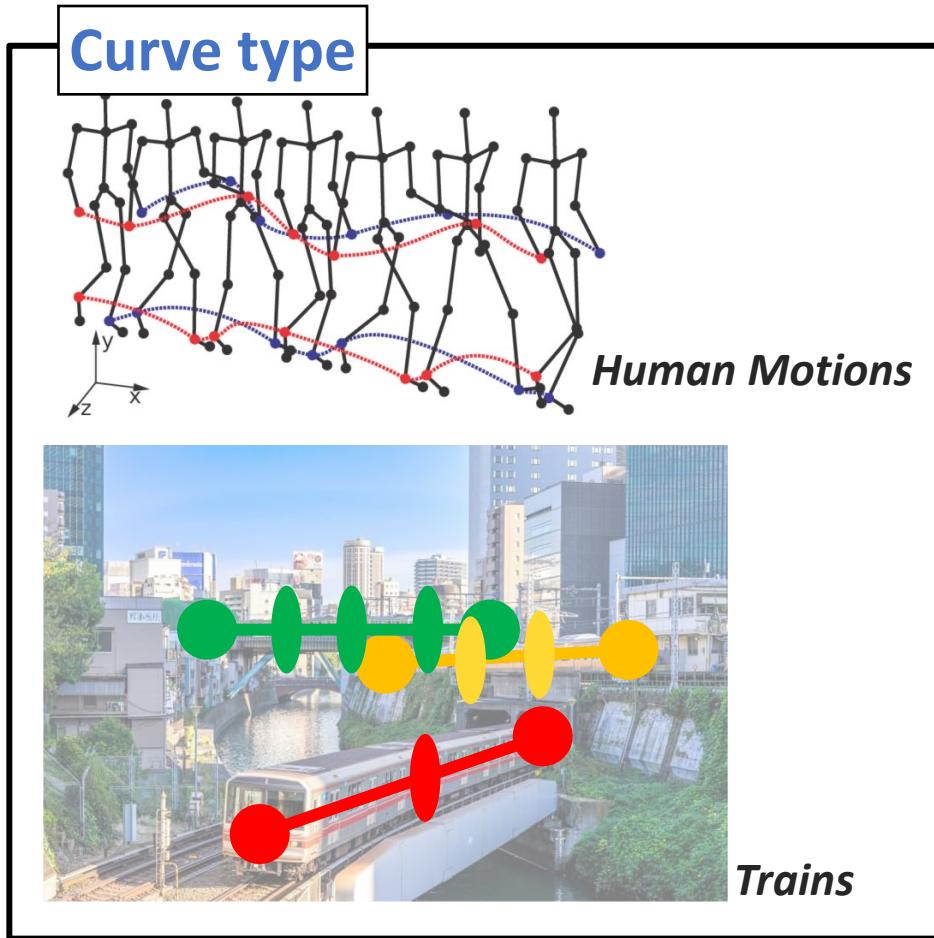


Image source:

1. <https://matcha-jp.com/en/4409>
2. <https://github.com/aistairc/mf-cesium/wiki/Stinuum-Web-Manual>
3. <https://www.robosense.ai/en/tech-show-55>
4. <https://www.sama.com/3d-lidar-radar-point-cloud-annotation/>
5. Balazia, Michal, and Petr Sojka. "Learning robust features for gait recognition by maximum margin criterion." *2016 23rd International Conference on Pattern Recognition (ICPR)*. IEEE, 2016.

OGC Moving Features SWG

Interoperability for spatiotemporal data and services

<https://www.ogc.org/standards/movingfeatures>

OGC Best Practice

OGC Standards

ISO Standards

Service Interface Specifications

16-120r3 Moving Features Access
(guideline for implementing interfaces to support moving feature data)

22-003r2 API – Moving Features – Part 1: Core
(for handling moving feature data over HTTP)

Encoding Specifications

14-084r2 Simple CSV
(compact encoding for massive moving points)

16-114r3 netCDF
(compact binary encoding)

19-045r3 MF-JSON
(for encoding 0D, 1D, 2D, and 3D moving features with dynamic non-spatial attributes) as an OGC Standard Encoding

18-075 XML Core
(for encoding trajectories)

Data Model (ISO 19141)

Moving Features 0D
(points)

Moving Features 1D/2D
(lines, curves, polygons, etc.)

Moving Features 3D
(cubes, spheres, 3D model, etc.)

OGC Moving Features JSON

- A new OGC standard for encoding and exchanging movement data of 2D and 3D objects



Github: <https://github.com/opengeospatial-mf-json>