INSPIRE

Infrastructure for Spatial Information in Europe

News from Standardisation Bodies

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Creator	EC and EEA INSPIRE Team
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Identifier	**MIG/14/2021/DOC3**
Description	This documents summarises new developments and activities relevant to INSPIRE maintenance and implementation from the following standardisation bodies:

- ISO/TC 211 Geographic Information/ Geomatics

- Open Geospatial Consortium (OGC)

- World Wide Web Consortium (W3C)

actions:	MIG to:

- Take note of the document

- Discuss possible coordinated actions related to the presented standardisation activities

1. ISO/TC 211 Geographic Information/ Geomatics

ISO/TC 211 develops open geospatial standards in close cooperation with other liaison organizations. Members participate through their national standards bodies. Members contribute by decision making setting the scope and strategic direction, by experts developing the standard documents, and by demonstrating the adoption and implementation of standards in their organizations. ISO/TC 211 is its members and liaisons.

1.1. Keeping updated and accessing ISO/TC 211 resources

As a complement to this news addressed to MIG, please find ISO/TC 211 Newsletter October 2021.

Register for the Open Standards in Action Seminar on November 26 2021, with theme "How to do the Standardisation?".

To be notified on news, publications, events or other updates, it is recommended to follow us on social media, e.g. LinkedIn.

On the committee website https://committee.iso.org/home/tc211, find useful information:

- Strategic business plan, Program of work, ongoing projects, list of all ISO/TC 211 standards.

- Freely available resources: UML, xml, terms, ontologies, ISO Geodetic register.

1.2. November Code Sprint on the Geospatial API's

ISO/TC 211 is pleased to be working with the Open Geospatial Consortium (OGC) on their November Code Sprint: Invitation to Participate in the November 2021 Geospatial API Virtual Code Sprint | OGC that was run from 15-17 November, with a pre-event orientation on 9 November.

This event focused on developing and testing implementations of *OGC API - Features* also known as ISO 19168-1:2020 *Geospatial API for features Standards*.

1.3. Other results from the committee

There are several advisory groups, ad hoc groups in addition to working groups and joint working groups.

Of particular interest:

- AHG 03 on non-relational database technologies. Analysing how existing ISO/TC 211 standards, having been designed when best practice implementation mainly meant relational databases communicating using XML, could be further developed to better suite other environments such as linked data or big data stores.

- AHG 05 on automated documentation.

- AHG 06 on following up the revised business plan on "digital transformation of public administration (e-government), focusing on how ISO/TC 211 standards could be further developed to be relevant for the digital decade of the digital transformation. A report will be presented for the committee in the end of November.

- AHG 07 on representing time. "Time" is not specific to geographic information and good practice and standards for describing temporal aspects of data exist in many other areas

- AHG 07 on establishing and maintaining ISO registers, for example the ISO geodetic register. Such procedures are important due to the need for new registers of standardized geospatial items.

- AHG 08 on Smart Cities. Noting the increased need to strengthen the collaboration with the Smart Cities groups in ISO and other standard organizations, ISO/TC 211 resolves to create an ad hoc group to study and suggest a way to move forward.

Collaborative work with OGC:

- PWI on Discrete Global Grid Systems - Part 2: Three-dimensional and Equivoque DGGS RS;

- PWI on Discrete Global Grid Systems - Part 3: Patio-temporal DGGS RS;

- PWI on Discrete Global Grid Systems - Part 4: Axis-aligned DGGS RS.

As reported earlier and in line with the committee openness for solutions facilitating for developers and users, ISO/TC 211 is participating in the pilot project on ISO Standards Machine Applicable, Readable and Transferable (SMART) Standards.

1.4. New standard projects

Several other initiatives are underway in the decision and voting process before formal start.

Of particular interest is the series of Land Administration Domain Models (LADM). The Working Titles of the parts are as follows:

Part 1 - Land Administration Fundamentals

Part 2 - Land Registration

Part 3 - Marine Space Georegulation

Part 4 –Valuation Information

Part 5 - Spatial Plan Information

Part 6 – Implementations. Separate NWIPs will be submitted for each other part.

For good governance, there is a general need to harmonize and integrate land administration / georegulation activities, which is also endorsed by the UN.

1.5. Recently published standards

Below is a list of publications since approximately May 2021:

1. ISO 19170-1:2021Geographic information —Discrete Global Grid Systems Specifications —Part 1: Core Reference System and Operations, and Equal Area Earth Reference System(2021-05-10)

2. ISO/TS 19166:2021Geographic information —BIM to GIS conceptual mapping (B2GM)(2021-05-14)

3. ISO/TR 23262:2021 GIS (geospatial) / BIM interoperability(2021-05-20 joint work with ISO/TC 59/SC 13)

4. ISO 19126:2021Geographic information —Feature concept dictionaries and registers(2021-05-26)

5. ISO19116:2019/Amd 1:2021Geographic information —Positioning services —Amendment 1(2021-06-08)

6. ISO/TR 19169:2021Geographic Information —Gap-analysis: mapping and describing the differences between the current GDF and ISO/TC 211 conceptual models to suggest ways to harmonize and resolve conflicting issues(2021-06-16)

7. ISO 19111:2019/Amd 1:2021Geographic information —Referencing by coordinates —Amendment 1(2021-06-21)

ISO/TC 59/SC 13/JWG 14 (joint working group between ISO/TC 59/SC 13 and ISO/TC 211) has developed a technical report on GIS-BIM interoperability, ISO/TR 23262 GIS (geospatial) / BIM interoperability. Based upon this a new work item proposal on "Geospatial and BIM review of vocabularies" is out for comments. The overall scope is to ensure that experts of these two domains have a joint understanding of the basic concepts.

1.6. Points of contact

Mr. Morten Borrebæk, ISO/TC 211 convenor Working group 4 Morten.Borrebaek@kartverket.no

Ms. Agneta Gren Engberg, ISO/TC 211 chair, agneta.gren.engberg@lm.se

2. Open Geospatial Consortium (OGC)

The OGC represents over 540 businesses, government agencies, research organizations, and universities united with a desire to make location information FAIR – Findable, Accessible, Interoperable and Reusable. Through the organization's member-driven consensus process, OGC Members create royalty free, publicly available open standards. Existing at the cutting edge, OGC actively analyses and anticipates emerging tech trends, and runs an agile, collaborative Research and Development (R&D) lab - the OGC Innovation Program - that uses collective solving mechanisms addressing and solving real-world geospatial challenges - building on experiences by our members and resulting in proof of concepts, best practices , Engineering Reports and prototype implementations.

OGC members together form a global network of experts and communities. Using location, the OGC connects people, communities, technology and decision making for the good of society.

Watch YouTube Video here.

2.1. 2021 recap (till Nov 2021)

- 12 Standards approved
- 3 Best and Community Practices approved
- 22 Engineering Reports approved
- 4 Discussion or Technical Papers approved
- 4 new Standards Working Group (SWG)
- 12 Innovation Program initiatives completed

2.2. Status of standardisation activities in 2021 (since Dec 2020)

- 12 Standards approved - since Dec 2020:
  - OGC 15-042r6: OGC TimeSeriesML 1.3
  - OGC 20-094: Indoor Mapping Data Format (IMDF) Community Standard
  - OGC 20-040r3: Abstract Specification Topic 21, Discrete Global Grid Systems – Part 1: Core
  - OGC 19-086r3: OGC API – Environmental Data Retrieval
  - OOGC 20-072r2: CityJSON 1.0 Community Standard
  - OGC 20-010r1: OGC CityGML 3.0 Conceptual Model
  - OGC 18-062r1 : OGC API - Processes - Part 1: Core
  - OGC 16-083r8 : OGC Coverage Implementation Schema ReferenceableGridCoverage Extension v.1.1
  - OGC 17-014r8 : Indexed 3d Scene Layer (I3S) and Scene Layer Package Format Specification version 1.2 Community standard
  - OGC 21-011r3 Simple Features 2021
  - OGC 17-066r2 GeoPackage Extension for Tiled Gridded Coverage Data 1.1
  - OGC 19-072r1 OGC API - Common - Part 1: Core

- 3 Best and Community Practices
  - OGC 20-095: Defence Geospatial Information Working Group (DGIWG) GeoTIFF/TIFF Profile for Imagery & Gridded Data 2.3.1 Best Practice
  - OGC 21-007: Defence Geospatial Information Working Group (DGIWG) GMLJP2/JP2 Profile for Imagery & Gridded Data 2.1.2 Best Practice
  - OGC 20-089r1 Best Practice for Earth Observation Application Package

- 22 Engineering Reports approved

  [Engineering Reports](#) are created as deliverables in the OGC Innovation Program to describe the work and results of interoperability initiatives. OGC Engineering Reports are not standards and should not be referenced as required or mandatory technology in procurements. However, the discussions in these documents could very well lead to the definition of OGC standards.

Since Dec 2020 the following ER have been approved:

- o OGC 20-027: OGC Testbed-16: Federated Security

- o OGC 20-025r1: OGC Testbed-16: Data Access and Processing API Engineering Report

- o OGC 20-020: OGC Testbed-16: Aviation Engineering Report

- o OGC 20-016: OGC Testbed-16: Data Access and Processing Engineering Report

- o OGC 20-039r2: OGC Testbed-16: DGGS and DGGS API Engineering Report

- o OGC 20-035: OGC Testbed-16: Earth Observation Application Packages with Jupyter Notebooks

- o OGC 20-041: OGC Testbed-16: Analysis Ready Data Engineering Report

- o OGC 20-019r1: OGC Testbed-16: GeoPackage Engineering Report

- o OGC 20-018: OGC Testbed-16: Machine Learning Training Data ER

- o OGC 20-033: OGC Testbed-16: OpenAPI Engineering Report

- o OGC 20-036: OGC Testbed-16: Full Motion Video to Moving Features Engineering Report

- o OGC 20-012: UML-to-GML Application Schema Pilot (UGAS-2020) Engineering Report

- o OGC 20-090: OGC API – Maps Sprint 2020: Summary Engineering Report

- o OGC 20-087: Interoperable Simulation and Gaming Sprint Engineering Report

- o OGC 20-015r2: OGC Testbed-16: Machine Learning Engineering Report

- o OGC 20-091: OGC API – Common and OGC API – Features Sprint 2020: Summary Engineering Report

- o OGC 20-021r2: OGC Testbed-16: Data Centric Security Engineering Report

- o OGC 19-081: MUDDI v1.1 (Model for Underground Data Definition and Integration) Engineering Report

- o OGC 21-008: Joint OGC OSGeo ASF Code Sprint 2021 Summary Engineering Report

- o OGC 20-083r2: Building Energy Mapping and Analytics: Concept Development Study Report

- o OGC 21-013: Modernizing SDI: Enabling Data Interoperability for Regional Assessments and Cumulative Effects CDS

- o OGC 20-058: Interoperable Simulation and Gaming Sprint Year 2 Engineering Report

- 4 Discussion/Technical Papers approved and published (since Dec 2020)

Discussion papers are documents that present technology issues being considered in the Working Groups of the OGC Technical Committee. Their purpose is to create discussion in the geospatial information industry on a specific topic. A Technical Paper is an OGC member approved publication released by the OGC to the public that states a position on one or more technical considerations, often including a high-level explanation of a standards based architecture or framework of a solution.

Both document types do not represent an official position of the OGC.

- o OGC 20-054r1: An Extension Model to attach Points of Interest into IndoorGML Discussion Paper

- OGC 19-091r2: Built environment data standards and their integration: an analysis of IFC, CityGML and LandInfra Discussion Paper

- OGC 20-088: Standardizing a Framework for Spatial and Spectral Error Propagation Discussion Paper

- OGC 20-085r1: Advancing the Interoperability of Geospatial Intelligence Tradecraft with 3D Modeling, Simulation, and Game Engines Technical Paper

- New Working Group initiated since Dec 2020
  - Features and Geometries JSON Standards Working Group (SWG)
  - Training Data Markup Language for AI/ML SWG
  - 3D GeoVolumes SWG
 - Planetary Domain Working Group (DWG)

2.3. OGC Standards Roadmap

The OGC API family of standards are being developed to make it easy for anyone to provide geospatial data to the web. These standards build upon the legacy of the OGC Web Service standards (WMS, WFS, WCS, WPS, etc.), but define resource-centric APIs that take advantage of modern web development practices.

The standards are being constructed as „building blocks" that can be used to assemble novel APIs for web access to geospatial content. The building blocks are defined not only by the requirements of the specific standards, but also through interoperability prototyping and testing in the OGC'S Innovation Program. Meanwhile the INSPIRE Community has taken up the OGC APIs in various communities of practice.

The OGC Standards Roadmap shows progress of official OGC Standards (in grey) and Community Standards (in blue).
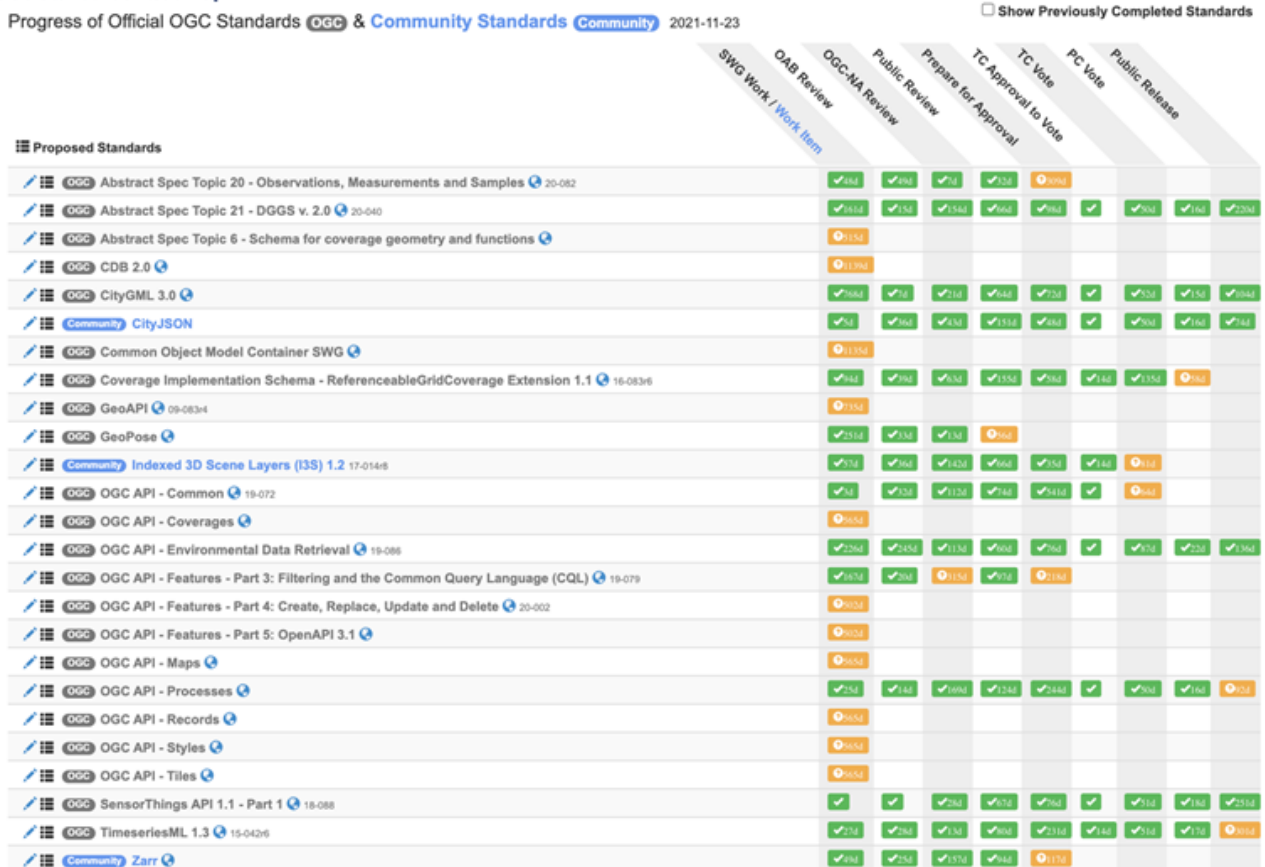
2.4. Sprints

OGC Sprints play an important role in the standards development process, as they allow moving discussions forward in an agile environment. At OGC Sprints, technology and domain experts, programmers and program managers come together to develop new and enhance existing OGC API specifications in an agile way. At OGC Sprints, APIs development is pushed forward and at the same time coordinated to ensure minimum redundancy and overlap and consistent use of common elements across the growing set of OGC APIs.

For upcoming Sprints, please check our website.

- Sprints in number:
    - 5 Sprints
    - 367 Participants
    - 10+ standards exercised

2.5. Member Meetings - aka Technical / Planning Committee Meetings

Last OGC Member Meetings have been moved to virtual ones, the schedule for 2021/2022 is below. OGC will adjust the schedule where necessary and appropriate. NOTE: OGC will SOMEDAY move to a long-term pattern of 3 physical and 1 virtual meetings per year, normally with virtual in December

- Upcoming Dec Member Meeting - Special Sessions

Date	Location	Host/Sponsor
14-18 June 2021	Virtual	
13-16 September 2021	Virtual	Singapore Land Authority
6 – 10 December 2021	Virtual	
March 2022	West Coast USA (TBD)	
June 2022	Europe (TBD)	
September 2022	Singapore	Singapore Land Authority
December 2022 Innovation Meeting	TBD	

- 07. Dec - Future Directions (featuring Testbed-17 results)
- 07. Dec - Start-ups & Industry Disruptors
- 08. Dec - Mobility Data Science Summit
- 08. Dec - Developer Workshop
- 08. Dec - Data Quality Workshop
- 09. Dec - The Future of Standards
- 09. Dec - Climate Change Special Session
- 09. Dec - Disaster Pilot Summary
- 09. Dec - Metaverse Special Session

2.6. OGC Innovation

The OGC Innovation Program is a forum for OGC members to solve the latest and hardest geospatial challenges via a collaborative and agile process. OGC members (sponsors and technology implementers) come together to solve problems, produce prototypes, develop demonstrations, provide best practices, and advance the future of standards. Since 1999, more than 100 funded initiatives have been executed - from small interoperability experiments run by an OGC working group to multi-million dollar testbeds with more than three hundred OGC-member participants.

A recent example is the Modernizing SDI Concept Development Study. Outcomes are available on the OGC website.

Ideas for future initiatives include:

- Testbed-18
    - Machine Learning
    - Big Data Analytics
    - Cloud optimized data
    - Systems at scale
  - Federated Marine SDI Pilot
  - Blockchain spatial objects
  - Built Environment Interoperability
  - UAS Command and Control
  - HD maps and autonomous vehicles
  - Digital Twins (urban, ocean, global)

2.7. Points of contact

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3. World Wide Web Consortium (W3C)

The World Wide Web Consortium (W3C) is an international community where Member organizations, a full-time staff, and the public work together to develop Web standards. Led by Web inventor and Director Tim Berners-Lee and CEO Jeffrey Jaffe, W3C's mission is to lead the Web to its full potential. Contact W3C for more information.

W3C has a large suite of standards (W3C Recommendations) for Web browsers (the Open Web Platform) and for the Web of Data. W3C features Working Groups that produce standards, Interest Groups, and Community Groups, the latter a popular means for incubating new work prior to transfer to the standards track.

W3C develops standards and guidelines in a wide range of web-related areas, including publishing, television, automotive, payments, telecommunication and the Web of Things; and covering many aspects, such as accessibility, security, data protection ('privacy'), internationalisation, data formats/protocols and APIs.

In fact, W3C tries to develop technologies that fit a common architecture and adhere to certain principles of accessibility, internationalisation, security, etc. It has dedicated groups to review proposed standards in that sense, such as the Technical Architecture Group (TAG), the Web Accessibility Initiative (WAI) and the Internationalization Working Group.

The following figure illustrates how W3C's suite of standards for data fit together, but omits more recent work, which is described in the text below.
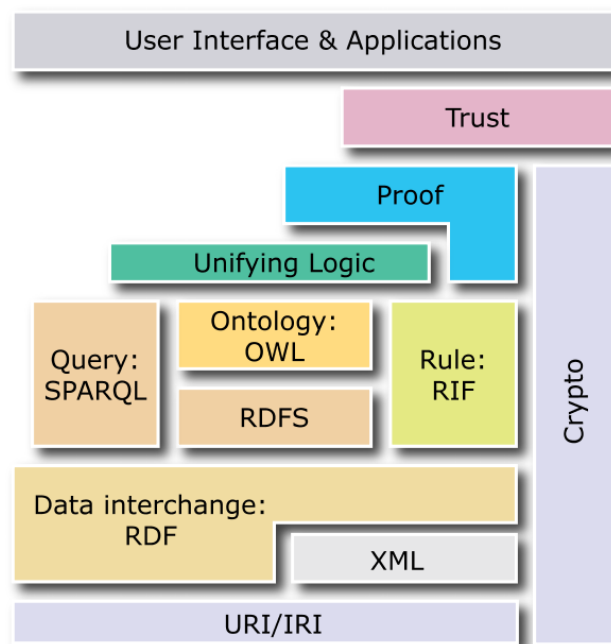
The Resource Description Framework (RDF) supports graphs with labelled directed edges, where the vertices and the edge labels are associated with URIs as globally unique identifiers, that may be dereferenceable to obtain further information, forming a Web of data and metadata.

RDF has a variety of serialisations including RDF/XML, Turtle, and most recently JSON-LD, which as the name suggests is based upon the JavaScript Object Notation (JSON). JSON-LD 1.1 was released as a Candidate Recommendation in December 2019.

SPARQL is a query language for RDF, analogous to SQL for RDBMS. The latest specification is SPARQL 1.1, and discussions are currently underway on whether to standardise further extensions to the core query language. The Linked Data Platform (LDP) defines a set of rules for HTTP operations on web resources, some based on RDF, to provide an architecture for read-write Linked Data on the web.

Vocabularies of terms for RDF can be expressed using RDF Schema (RDFS) and OWL (the Web ontology language), which is based on description logics with some additional features for versioning

and annotations. The latest version is OWL2 and includes three variants with different levels of expressiveness (Lite, DL and Full).

The RDF Shapes Constraint Language (SHACL) provides a language for validating RDF graphs against a set of conditions. SHEX is a proposed structural schema language for validation, traversal and transformation of RDF graphs, that is inspired by regular expressions for string literals.

The Rule Interchange Format (RIF) provides a means for exchanging rules between rule systems, as it was clear that a single language would not satisfy the needs of many popular paradigms for using rules in knowledge representation and business modelling. RIF distinguishes logic-based rules from action-based rules.

W3C's Spatial Data on the Web (SDW) Working Group produced two W3C Recommendations in collaboration with OGC: the Time Ontology in OWL and the Semantic Sensor Network Ontology (SSN), which can be used to describe sensors and their observations, the involved procedures, the studied features of interest, the samples used to do so, and the observed properties, as well as actuators. While the SDW WG was closed, between 2018 and 2021, the Spatial Data on the Web Interest Group continued the collaboration with the OGC, working together on extensions to SSN, including SOSA as a lightweight ontology for sensors, observations, samples and actuators, that enables better linking, and homogeneous collections of observations.

W3C's Web of Things Interest Group and Working Group have both been rechartered, in 2019 and 2020, respectively, and have developed standards for digital twins that decouple client applications from the physical location, and the communications technologies for connecting to sensors and actuators. W3C Recommendations have been prepared for Thing Descriptions and Architecture. Related work has focused on security and a proposed scripting API.

On a related note, W3C is hosting work on extensions to schema.org to support IoT devices, whilst the Linked Building Data Community Group focuses on building information modelling (BIM) and Web of Data technologies to define existing and future use cases and requirements for linked data applications.

The Dataset Exchange Working Group has released a second version of the data catalogue vocabulary (DCAT2). DCAT is an RDF vocabulary designed to facilitate interoperability between data catalogues published on the Web. The Working Group is continuing related work on guidance on publishing application profiles of vocabularies, content negotiation by profile and a vocabulary for describing profiles of standards for information resources.

W3C held a workshop on graph data in Berlin in March 2019, bringing together practitioners from the communities for RDF/Semantic Web/Linked Data, SQL/RDBMS and Labelled Property Graphs, with a view to improved liaison and to inform future work on the Web of Data. The Easier RDF initiative is seeking to make semantic technologies easier for the average developer.

The Web of Things was the topic of a workshop in June 2019, called the 'Second W3C Workshop on the Web of Things', The discussions covered a wide range, from ontologies and APIs to applications and security, but also relations to other standards, such as NGSI-LD and ETSI/FIWARE.

A workshop on 'Data Models for Transportation' in September 2019 was, as the name implies, about exchange of data related to cars, traffic, transportation, maintenance of cars, logistics, but also interaction between cars and a 'smart city'.

A workshop called 'Inclusive Design for Immersive Web Standards' in November 2019 discussed accessibility of virtual-reality and augmented-reality interfaces.

Another workshop, in September/October 2020, discussed 'Maps for the Web'. This workshop, in fact a series of workshops over a two-week period, was co-organised by W3C and OGC. It focused on online user interfaces for maps, with topics such as accessibility, augmented reality, internationalisation, reactivity (fast response), and the corresponding data formats, ontologies and APIs.

A workshop in June 2021 on 'Smart Cities' talked, among other things, about location data for transport, healthcare or environmental protection, and about trust, security and data protection. People at the workshop also discussed the relations between various existing standards, organisations and projects (Eclass, ISO IEC JTC1, Industry 4.0, GoEasy project…).

3.1. The emergence of the Sentient Web and the disruptive impact of Cognitive AI

From a strategic perspective, the way that information is held and processed is likely to change very considerably over the next decade as graph representations are combined with statistical information that reflect prior knowledge and past experience, inspired by advances in the cognitive sciences and hundreds of millions of years of evolution.

This is needed to support the next generation of machine learning as well as forms of reasoning that rely on statistical considerations, such as abduction which seeks explanations of observed behaviour. Traditional approaches struggle in respect to the uncertainty, incompleteness and inconsistency commonly found in real-world situations. This exacerbates the cost for preparing and cleaning data prior to analysis, a major bugbear for data science.

Relational databases are giving way to graph databases, and will in turn give way to cognitive databases that combine graph data, statistics, rules and graph algorithms. The Sentient Web is a vision for how the Web will evolve to combine sensors and actuators together with cognition, machine learning and AI as a basis for new ecosystems of smart services. See W3C's Cognitive AI Community Group for further background.

A workshop on 'Web and Machine Learning' in August and September 2020 explored some aspects of this, with topics such as neural network APIs, packaging of learned models, graph databases, and anonymous (or privacy-preserving) data.

3.2. News

The Web and Networks IG is exploring opportunities arising from the advent of 5G, high bandwidth and low latency networking. The Web GPU Graphics WG is developing an API for web applications to exploit GPUs from web page scripts. The Immersive Web WG is creating some basic building blocks in respect to high-performance Virtual Reality (VR) and Augmented Reality (AR) (collectively known as XR) to the open Web via APIs to interact with XR devices and sensors in browsers.

The Accessible Platform Architectures Working Group (one of the groups in W3C's Web Accessibility Initiative) has started studying the accessibility of such virtual-reality and augmented-reality interfaces and has so far published draft documents on requirements: 'XR Accessibility User Requirements'.

In addition, W3C community groups cover a wide area of topics, including active work on RDF-star, N3, ShEx and SPARQL extensions.

RDF-star (a.k.a.'RDF*') is an extension of RDF that makes it easier to write statements about other statements and it provides better interoperability with Property Graphs. The possibility of setting up a Working Group for the standardisation of RDF-star and SPARQL-star in 2022 is currently in study.

In October 2021, the joint OGC/W3C Working Group on Spatial Data on the Web was reopened. The SDW WG's charter is to update and extend the previous W3C Recommendations ('Time Ontology' and 'Semantic Sensor Network Ontology') and to write additonal documents: a W3C Note on 'Spatial Data on the Web Best Practices', a W3C Note on 'The Responsible Use of Spatial Data' and a W3C Note on 'WebVMT: The Web Video Map Tracks Format'. The group is also in charge of testing the W3C Recommendations and may publish other, non-normative documents.

The SDW WG held a joint session with the Web of Things WG at the W3C Technical Plenary meeting ('TPAC') in October in preparation for work on semantic annotation of geospatial data, and on discovery of data.

One of W3C's Community Groups held a meeting during TPAC on 'Maps for HTML', with participation from members of the SDW WG. The goal of this work is eventual integration into HTML (and related JavaScript APIs) of map-based input for forms, and the accessibility aspects of such forms. This is 'pre-standardisation' work, as is often done by W3C Community Groups.

Planned work of the Spatial Data on the Web WG for 2022 further includes a W3C Note on 'Spatial Data on the Web 2022', with an outlook on where spatial data may have most impact.

3.3. Points of contact

Bert Bos - bert@w3.org - is the W3C team contact for the Spatial Data on the Web Working Group; Philippe Le Hégaret - plh@w3.org – is the team contact of the Dataset Exchange Working Group and the JSON-LD Working Group.