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Implementation and adoption of standards for the global geospatial information community

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Note by the Secretariat

Summary

The present paper contains the report prepared jointly by the Open Geospatial Consortium, technical committee 211 of the International Organization for Standardization (ISO) and the International Hydrographic Organization for consideration by the Committee of Experts on Global Geospatial Information Management.

At its eighth session, held in New York from 1 to 3 August 2018, the Committee of Experts adopted decision 8/107, in which it expressed its appreciation to the three standards development organizations for their continuing support and valuable work. The Committee appreciated the revision of the report entitled "A guide to the role of standards in geospatial information management" and its companion document on standards recommendations by tier and encouraged the United Nations Global Geospatial Information Management regional committees and thematic groups to continue to raise awareness about and engage in the promotion of internationally agreed standards. In this present report, the three organizations elaborate on their collective efforts, including the Open Geospatial Consortium's work on developing standards based on application programming interfaces and establishing the statistical domain working group in the area of statistical-geospatial integration; work regarding the S-121 standard on maritime limits and boundaries, which is a pilot project undertaken by the International Hydrographic Organization and the Open Geospatial Consortium; the continued development of the ISO 19152 Land Administration Domain Model by technical committee 211; and collaboration with the United Nations Global Geospatial Information Management Academic Network on the role of standards in measuring and monitoring the Sustainable Development Goals.

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I. Introduction

1. At its eighth session, held in New York from 1 to 3 August 2018, the Committee of Experts adopted decision 8/107, in which it expressed its appreciation to the three Standards Development Organizations (SDOs), the Open Geospatial Consortium (OGC), technical committee 211 of the International Organization for Standardization (ISO/TC 211), and the International Hydrographic Organization (IHO), for their continuing support and valuable work. The Committee appreciated the revision of the report entitled "A Guide to the Role of Standards in Geospatial Information Management"[1] and its "Companion document on Standards Recommendations by Tier"[2] and encouraged the United Nations Global Geospatial Information Management regional committees and thematic groups to continue to raise awareness about and engage in the promotion of internationally agreed standards.

2. The present report provides an update on the work of the SDOs, which includes: developing standards based on application programming interfaces and establishing the Statistical Domain Working Group in the area of statistical-geospatial integration; work regarding the S-121 standard on maritime limits and boundaries, which is a pilot project undertaken by the IHO and the OGC; the continued development of the ISO 19152 Land Administration Domain Model; and collaboration with the United Nations Global Geospatial Information Management Academic Network on the role of standards in measuring and monitoring the Sustainable Development Goals (SDGs).

3. The Committee of Experts is invited to take note of the report and to express its views on the way forward for the implementation and adoption of standards for the global geospatial information community. Points for discussion and decision are provided in paragraph 32.

II. Update on the work of the Standards Development Organisations

4. Each SDO convenes technical and/or plenary meetings each year. The following is a brief update of the significant developments for each organization and the key areas of joint and collaborative work being undertaken.

Update from the Open Geospatial Consortium

5. Since August 2018, the OGC membership convened four technical meetings in Belgium, Germany, Singapore, and the United States of America. Future technical meetings of the OGC will take place in Canada (September 2019), France (December 2019), Hong Kong (March 2020), and Canada (June 2020). At the regional level, OGC regional fora have increased in number and attendance, these fora include: Asia; Australia and New Zealand; China; Europe; France; Iberian and Latin-American; India; Republic of Korea; Middle East and North Africa; Nordic; North American; and, United Kingdom of Great Britain and Northern Ireland. A further event of significance is the Location Powers: Data Science Summit. This is scheduled to take place in California in November 2019 and seeks to bring together the broader data science community into collaboration and knowledge sharing with the geospatial data science community.

6. The OGC has approved several new standards since August 2018 and encourages the Committee of Experts to review and implement these where appropriate. OGC would like to highlight the significant and critical work towards the suite of new OGC API (Application Programming Interface) standards. These standards, which are scheduled to begin an

[1] http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Standards_Guide_2018.pdf
[2] http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Standards-by-Tier-2018.pdf

approval process in late 2019, are a recognition of the move towards the use of APIs within the industry and a key evolution in the webservice standards that have underpinned international geospatial data sharing for more than 20 years. Whilst OGC's existing webservice standards will continue to be maintained, and it is expected that minimal revisions will be made to them, the momentum of development will move to the use of the OGC API suite for sharing geospatial data via the web. The initial standards being developed in 2019 includes OGC API – Common; OGC API – Features; OGC API – Processes; OGC API - Map Tiles; and, OGC API – Coverages. Further information and guidance will be made available as these standards are approved. Additionally, Member States are strongly encouraged to follow, provide input into, and review these important standards as they are finalized and approved[3].

7. Key OGC Standards that have been approved since August 2018 include: MetOcean Profile; HDF5 Core Standard; Symbology Conceptual Core Model; Revision GML JPEG 2000; Joint OGC/W3C Time Ontology in OWL (OWL-Time) and Semantic Sensor Network (SSN) Ontology standards prepared by the Spatial Data on the Web Working Group and published as W3C Recommendations; 3D Tiles Community Standard; Geopackage Related Tables Extension; Features and Geometries - Part 1 - Feature Models; Well Known Text Representation of Coordinate Reference Systems; and, OpenSearch for Earth Observation.

8. Recognising the importance of the review of the third edition of the Future Trends in Geospatial Information Management Report, the OGC will provide resources from its OGC Future Trends activity. This activity supports the understanding of prevailing developments and the potential impact of disruptive technology for the geospatial industry. This work is a collaborative effort of its members, overseen by its Open Architecture Board, and updated quarterly. This will support the identification of technology trends that will impact or guide geospatial standards work. Also, the work of several OGC working groups that discuss domain specific requirements will be leveraged to utilise existing resource.

9. Domain Working Groups (DWG) are at the heart of the OGC's development of standards, by providing 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. Since August 2018 new DWGs that have been formally approved include: Modelling and Simulation; Artificial Intelligence in GeoInformatics; Blockchain and Distributed Ledger Technologies; Portrayal; and Statistical.

10. Considering the work and activities of the Committee of Experts, the OGC would like to highlight:

(a) The formation of the Statistical DWG[4] in December 2018 at the OGC Technical Meetings in the United States of America. The intent of the Statistical DWG is to work in collaboration with the United Nations Expert Group on the Integration of Statistical and Geospatial Information and provide the technical capacity towards better coordination with the framework and policy guidance activities of the Expert Group. This relationship will be further strengthened by the Statistical DWG convening its next meeting on the margins of the European Forum for Geography and Statistics Conference in October 2019, where the Expert Group will also hold its sixth meeting.

[3] https://www.opengeospatial.org/blog/2996
[4] http://www.opengeospatial.org/projects/groups/statisticaldwg

(b) The "White Paper on Land Administration"[5], published by the OGC Land Administration working group in February 2019. This provides an overview of the land administration domain and proposes actions needed for design and development of implementation standards this domain and this will be accelerated through a close collaboration between the OGC and ISO.

11. Key international interoperability projects that have been concluded or initiated since August 2018 include: Vector Tiles Pilot; Marine Spatial Data Infrastructure Concept Development Study; CDB Vector Data in Geopackage Interoperability Experiment; Disasters Pilot; Testbed 15; Mixed Reality to the Edge Concept Development Study; Disaster Resilience and GEOSS Architecture Implementation Pilot; SCIRA Smart Cities Public Safety Interoperability Pilot; Open Routing Interoperability Pilot; Maritime Limits and Boundaries Pilot; Second Environmental Linked Features Interoperability Experiment; a CityGML Hackathon; and, an OGC API Hackathon.

12. As part of the celebration of the 50th Anniversary of Earth Day in 2020, the OGC is partnering with the Earth Day Network, the Woodrow Wilson International Center for Scholars, and the U.S. Department of State (through the Eco-Capitals Forum), for the Earth Challenge 2020[6]. This initiative is also in collaboration with the Connect4Climate partnership, consisting of the World Bank Group, Conservation X Labs, Hult Prize, National Council for Science and the Environment (NCSE), Reset, SciStarter, UN Environment and others to be announced. Specifically, the OGC Citizen Science DWG is assisting in the development of the necessary schema for citizen collected/crowdsourced geospatial data. A further point of interest is that World Earth Day coincides with the first day of the upcoming Sixth High Level Forum on UN-GGIM, 22 April 2020.

13. The Committee of Experts are invited to take note of this work and to urge Member States to participate in the future meetings of the OGC, especially regarding the work and activities of the Statistical DWG, to support standards development in the domain of the integration of statistical and geospatial information.

Update from the technical committee 211 of the International Organization for Standardization

14. Since August 2018, the ISO/TC 211 membership has convened two plenary meetings, in Wuhan, China (47th) in November 2018, and in Maribor, Slovenia (48th) in June 2019. The committee comprises of 39 Participating Members, including new members Chile and Uganda, and 31 observers. Furthermore, ISO/TC 211 continues to strengthen its relationship with other ISO committees requiring geospatial information, with more than 20 committees liaising with ISO/TC 211. ISO/TC 211 would like to highlight:

(a) The ISO/TC 59/SC 13 and ISO/TC 211 Joint Working Group 14 for the interoperability between GIS (Geospatial) and BIM (Building Information Models), which has been established and has operated during the intersessional period. The Joint Working Group is in the process of producing a technical report on interoperability barriers and possible measures, with the intention of this paper being published in October 2019. This paper will serve as a foundation for further actions in the joint working group or in the respective committees; and,

[5] http://docs.opengeospatial.org/wp/18-008r1/18-008r1.html

[6] This is a Citizen Science initiative, aimed at engaging millions of global citizens as volunteers to aggregate and collect more than one billion data points in areas including air quality, water quality, biodiversity, pollution, and human health. Through Earth Challenge 2020, citizen science volunteers will learn about their local conditions, and leverage information to inspire collaborative action and influence policy decisions

(b) The establishment of the ISO/TC 211 and ISO/TC 204 joint working group 11 on GIS and Intelligent Transport Systems (ITS), to further support the use of geospatial information within the ITS domain.

15. Collaboration with other organizations is essential for increasing the benefits and outcome of the work in international standardization, and more than 30 organizations are liaised with ISO/TC 211. The integration of geomatics standards with Information Communication Technologies in general implies a specific focus on eGovernment and semantic web and are detailed within its freely available resources section to support standards implementation[7]. During its 48th plenary meeting in Maribor, Slovenia, ISO/TC 211 decided to establish a category C liaison[8] between the World Wide Web Consortium (W3C) and WG4 of ISO/TC 211. A closer relationship with W3C may increase the uptake of geospatial information within the eGovernment infrastructure and further influence work on location enablement and location intelligence. Furthermore, to support project leaders for cooperation between ISO/TC 211 and the OGC, a guidance document for joint works will be developed to ensure the alignment of the working processes and to support the deepening of collaboration. Users may also benefit from this in terms of a clearer understanding of the standards development process.

16. The work of ISO/TC 211 has a strong relevance to the work of the Committee of Experts, this includes:

(a) **Integrated Geospatial Information Framework**. The ongoing work on WFS 3.0 in close cooperation with OGC is planned to be submitted as a Draft International Standard in July 2019. The title in ISO will be "ISO 19168-1 Geographic Information - Geospatial API for Features - Part 1: Core";

(b) **Fundamental Global Geospatial Data Themes.** Several of the ISO/TC 211 standards are now revised and available as the second generation of standards. Many of these are referenced in legislation such as European Commission INSPIRE implementing rules;

(c) **Global Geodetic Reference Frame.** The ISO Geodetic Register[9], a structured and quality assured database of coordinate reference systems and transformations, accessible through an on-line registry system, and maintained by a control body of geodetic experts, has recently been publicly released and made freely available. Other developments in the field of geodetic standards are the ongoing project ISO 19161 "Geographic Information - Geodetic references - Part 1: International Terrestrial Reference System (ITRS)" and its connection to the Global Geodetic Reference Frame (GGRF), and the ongoing project ISO 19170 "Geographic Information - Discrete Global Grid Systems (DGGS)"[10]*;* and,

(d) **Land Administration.** The revision of ISO 19152:2012 Geographic information - Land Administration Domain Model (LADM) continued during the intersessional period. An initial LADM draft was issued to key stakeholders seeking their comments and at the recent ISO/TC 211 Plenary meeting in Maribor, Slovenia, it was agreed to have a multi-part standard as

7 https://committee.iso.org/sites/tc211/home/re.html

8 "Organizations that make a technical contribution to and participate actively in the work of a working group, maintenance team or project team". For more information: https://www.iec.ch/standardsdev/how/partners/cat_c.htm

9 https://registry.isotc211.org

10 This also benefits the work of the Fundamental Global Geospatial Data Themes and the Global Statistical Geospatial Framework.

follows: (a) Land Administration Fundamentals; (b) Land Tenure or Land Registration or Land Interest; (c) Marine Space or Marine Geo-Regulation; (d) Land Valuation; (e) Spatial Planning; and, (f) Implementations. Further engagement with OGC, IHO, FIG, United Nations Office of Legal Affairs' Division for Ocean Affairs and Laws of the Sea (DOALOS), World Bank, FAO, and UN- Habitat is planned to ensure the proposed parts cover the organisational requirements. Once this is completed, drafts of the various parts of the LADM standard will be submitted to ISO/TC 211 as a working draft.

17. ISO/TC 211 is conducting work to support the broader objectives of the 2030 Agenda for Sustainable Development, including work towards supporting the development of standards within the domains of Land Cover and Land Use, and Addresses.

18. Land Cover and Land Use are essential and fundamental data themes used by millions of professional users globally across a wide variety of applications. The outputs of these in turn support Location Applications that billions of people use on their personal devices. While the explosion of Location Intelligence tied to these essential data layers continues at a pace, the growing need for an agreed upon Land Cover and Land Use meta language is more urgent than ever. ISO 19144-2:2012 "Geographic information - Classification systems -- Part 2: Land Cover Meta Language (LCML)" was developed under the leadership of FAO. A revision and expansion of this standard, extending the Land Cover Meta Language to resolve inconsistencies and remove land use concepts, is currently in preparation at ISO/TC 211. The full report will be available prior to the ISO/TC 211 meeting in December 2019. A draft scope for the revision and development was presented at 48th plenary meeting in Maribor, Slovenia, proposing the following three aspects:

(a) Revision of ISO 19144-2:2011 on Land Cover, in order to incorporate the comments received on the systematic review; to revise in a backward compatible manner; to remove the few elements of Land Use that currently exist in the standard, and build a 'bridge' that allows elements to be added as additional information taken from a future Land Use standard; to support the EIONET requirements and ensure that the EAGLE model will be a valid profile. Work on the revision is expected to start in December 2019;

(b) Produce a separate document ISO 19144-4 on Registers, which is extracted from the section of ISO 19144-2 which describes these registers. A register will allow extension and support to the current standard, and to a future ISO 19144-3 Land Use Metalanguage standard. Registers greatly improve the use of the standards by registration of model elements, codelist elements, and complete legends described using the metalanguage. i.e. allows for the recording of complete legends of Land Cover and Land Use; and,

(c) For Land Use, develop a new separate meta language standard to address Land Use, potentially as ISO 19144-3. This work should begin when the revision of ISO 19144-2 is in process and run in parallel.

19. Addresses provide one of the most common ways to unambiguously determine an object for purposes of identification and location; assisting such services as postal delivery, emergency response, marketing, mapping, utility planning and land administration. As such it is one of the global fundamental geospatial data themes. ISO/TC 211 has published a multi-part ISO 19160 "Addressing" standard to assist the plethora of stakeholders involved in addressing. The parts cover such topics which include: A conceptual data model; Terms and definitions for address information; Good practices for address assignment; Quality of address data; and, A standard jointly developed with the Universal Postal Union (UPU) on international postal addressing. During the intersessional period, the following developments have taken place: 1) Work on Part 6 of ISO 19160 has been initiated. The aim of this standard

is to facilitate the digital exchange of addresses conforming to country-, region- or domain-specific profiles of ISO 19160-1:2015 “Addressing - Part 1: Conceptual model”. Implementation of the standard will make it possible to capture and verify addresses online based on respective national address standards. The project is led by CalConnect, publisher of the vCard specification. 2) Work on Part 2 of the ISO 19160 was cancelled in 2018, but there is still interest from various ISO/TC 211, member bodies and liaison organizations in continuing with the work on good practices for address assignment. An informal meeting is being planned, to be held on the margins of the the next ISO/TC 211 plenary week. This is aimed at discussing standardization requirements and a possible scope of future work.

20. Translation is one example of means of making terms and standards more available. In 2018-2019 the second edition of the Russian language version for Multilingual Glossary of Terms has been prepared. This includes nearly 1,000 terminologies. Also, 41 complete standards in the ISO 19100-series have been translated into Russian. ISO/TC 211 follows standards in action on a regular basis. One example reported from the Czech Republic, is the use of the standard ISO 19112:2019 “Spatial referencing by geographic identifiers”, which played a significant role in the national census, in connecting residential units to census units.

21. The 50th and next plenary meeting of the ISO/TC 211 will be held in Omiya, Japan, from 9-13 December 2019.

Update from the International Hydrographic Organisation (IHO)

22. The IHO continued to work on its S-100 framework to support the creation and maintenance of interoperable maritime data product specifications compliant with of the ISO-19100 series of geographic information standards. Before coming into force at the operational level, product specifications for Bathymetric Surface (S-102), Surface Currents (S-111), Marine Protected Areas (S-122), and Under Keel Clearance Management (S-129) for vessels navigating in waters of restricted depths received already approval for testing and experimentation by the IHO Committee in charge of technical standards.

23. Next steps include development of interoperability rules to ensure that these products can be used at the operational level together with Electronic Navigational Charts (S-101). This also ensures that all data flows are well managed, that data qualification requirements are consistent, and data protection schemes can be applied to before distribution to end-users and stakeholders. Numerous IHO Member States currently undertake significant efforts to set up regular and frequent services of such datasets with national and regional coverage. Since the S-100 framework and the associated web-based infrastructure is not limited to host data product specifications native to the hydrographic domain, the IHO is proactively supporting the expansion of the S-100 concept to related domains such as maintenance of fixed and floating aids to navigation (with the International Association of Marine Aids to Navigation and Lighthouse Authorities), weather (with the WMO), and sea ice coverage and oceanography (with UNESCO’s Intergovernmental Oceanographic Commission). The most notable progress was made with the Water Overlay (S-412), specifically the weather wave hazards overlay, designed for digital nautical chart systems (Electronic Chart Display and Information System). Since its approval, the National Oceanographic and Atmospheric Agency of USA announced to start provision of S-412 data sets for the western Atlantic.

24. As reported to the Committee of Experts at previous sessions, IHO assists DOALOS with the development of an S-100 based standard for Maritime Limits and Boundaries (S-121), which aims to support United Nations Member States in their United Nations Convention for the Law of the Sea (UNCLOS) depository obligations. The first version of this technical standard is in its final stages of its development and will require further consideration regarding its implementation, prior to its submission to IHO Member States for their adoption and endorsement.

25. To improve the rather fragmented image of the topography of the oceanic seabed from all available data resources, IHO has started its "Crowd Sourced Bathymetry Campaign".[11] A fundamental building block of this effort is the provision of technical guidance (IHO B-12) on how vessels can contribute depth soundings to IHO´s Data Centre for Digital Bathymetry (DCDB) collected by using standard navigation instruments, while engaged in routine maritime operations. The resulting grid of global ocean sea bed topography is publicly available under open data policy terms for download and re-use.

26. Furthermore, the IHO remains also deeply involved in undersea features naming as it was reported at the 1st Session of the United Nations Group of Experts on Geographical Names (UNGEGN).

III. Geospatial standards in measuring and monitoring the Sustainable Development Goals

27. To highlight the importance of standards in the advancement of geospatial information, ISO/TC 211 actively participated and presented during the "Standards that make Innovation Possible"[12] session during the United Nations World Geospatial Information Congress in Deqing, China. This presented information on current standards in development, how to apply standards in daily geospatial information responsibilities, and suggested various resources helpful to organizations responsible for geospatial information.

28. The SDOs have contributed to a chapter on standards in the book "Sustainable Development Goals Connectivity Dilemma: Land and Geospatial Information for Urban and Rural Resilience" published in 2019 by the UN-GGIM Academic Network and towards the development of the draft Strategic Pathway 6: Standards of the Integrated Geospatial Information Framework.

29. For the ISO central secretariat, extending the relationship with the United Nations and the 2030 Agenda for Sustainable Development has been a priority for ISO leadership, particularly over the past two years. ISO provides tools, and invites committees, to help map their projects to any or many of the SDGs. The standards of ISO/TC 211 are mapped to the SDGs and published on the committee web page. In new proposals for standards, there is an option to indicate which SDGs are involved, so this information will be known in the project at an early stage. This recognises that many, if not most, ongoing standard projects relate to the SDGs. This also considers that the relationship may be indirect at times, as for instance many fundamental standards support global fundamental data, which in its turn support the SDGs.

30. Since August 2016, the three SDOs have had ongoing discussions regarding the use of geospatial standards in supporting the measurement and monitoring of the SDGs. The focus areas include: (a) Goal 2 - Zero Hunger (land cover/land use – ISO/TC 211); (b) Goal 11 - Sustainable Cities and Communities (Smart Cities DWG is supporting use case definition including SDGs and standards, SCIRA and ESPRESSO Projects - OGC); and (c) Goal 14 - Life Below Water (maritime boundary limits - IHO).

31. Besides the work of the SDOs themselves, the SDOs or members of the SDOs, are active and support the work and activities of the Committee of Experts, including the Subcommittee on Geodesy, and its Expert and Working Groups. The SDOs will continue to provide guidance on the use of geospatial standards and enable the geospatial and metadata needs which the measurement and monitoring of the SDGs will require.

[11] https://www.ngdc.noaa.gov/iho/#csb
[12] http://ggim.un.org/unwgic/nov20-parallel-Standards-That-Make-Innovation-Possible/

IV. Points for discussion

32. The Committee of Experts is invited to:

(a) Take note of the present report and express its views on the activities and important work undertaken by the three standards development organizations, in facilitating the Integrated Geospatial Information Framework and towards achieving the Sustainable Development Goals;

(b) Take note of the public release of the ISO Geodetic Register and other freely available resources in support of standards implementation;

(c) Take note of progress towards the development of an international standard for a Discrete Global Grid System, the revision of the Land Administration Domain Model, and OGC API standards;

(d) Encourage participation of Member States in the preparatory work on the international standards on Land Cover and Land Use, and on Good practices for Address Assignment, and to participate in the Statistical Domain Working Group; and,

(e) Urge Member States to participate, through membership, in the international geospatial standards development processes of OGC, ISO/TC 211, and IHO.