PlanetData

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D20.4 Call 2: Linked Map Standardization report

Coordinator: Francisco J Lopez-Pellicer (UNIZAR)
With contributions from: Jesús Barrera (GEOSLAB)

1st Quality reviewer: Alexandra Moraru (IJS)
2nd Quality reviewer: Loris Bozzato (FBK)

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Abstract

This deliverable describes emerging standards related to Linked Data best practices and geographic information that have been applied to the project as well as the contribution of the project results to standardization forums and working groups.

Executive summary

This deliverable describes standardization activities related to Linked Data best practices and geographic information standards that are applicable to the Linked Map subproject of the PlanetData project. The standardization work performed during the project has been two fold: the adoption of geographic information standards and the dissemination of results related to their use. There are several relevant bodies and initiatives involved in the standardization of geographic information and its services directly or indirectly now: Open Geospatial Consortium (OGC), World Wide Web Consortium (W3C), International Organization for Standardization (ISO), and Internet Engineering Task Force (IEFT).

The project has adopted mature and emerging standards and best practices concerned with Web technologies (e.g. OGC WMS), semantic interoperability (e.g. Linked Data), and provenance description (e.g. W3C PROV). Most of them have been issued by OGC and W3C. The experiences and lessons learned from each standard have been detailed in different deliverables of WP 16 and WP 17 (D16.1, D16.2, D16.3, D16.4 and D17.1). This deliverable organizes, completes and provides an index for locating all relevant information associated with the adopted standards quickly.

From our experience, we believe that the Linked Map subproject can contribute to standardization bodies with insights and experiences in some topics, such as REST geoservices, integration of geoservices with Linked Data and provenance of geographic information. As a result, project members have started activities related to spreading and discussing results with people implicated in the elaboration and maintenance of adopted standards. Activities include dissemination of experiences in mailing lists, participation in community forums, and change requests to existing standards and best practices.

Standardization activities are complex and require time and commitment by researchers. Linked Map is a short-term project (1 year) within PlanetData. The measurement of the success of disseminating results among standardization bodies should be performed after the ending of the project due to the slow pace of standardization work. Hence, standardization activities will continue after the end of the project. This deliverable includes a sustainable standardization plan to be undertaken after the end of the project.

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Authors (Partner)	Francisco J Lopez-Pellicer (UNIZAR), Jesús Barrera (GEOSLAB)			
Responsible Author	Name	Francisco J Lopez-Pellicer	E-mail	fjlopez@unizar.es
	Partner	UNIZAR	Phone	+34 876555552

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Abbreviations

AENOR	Asociación Española de Normalización y Certificación
BSI	British Standards Institution
DIN	Deustches Institut für Normung eV
DL	Description Logics
GI	Geographic Information
GIS	Geographic Information System
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
ILAF	OGC Iberian and Latin-American Forum
IRI	Internationalised Resource Identifier
ISO	International Organization for Standardization
LDP	W3C Linked Data Platform
LMS	Linked Map Service
NGO	Non-governmental organization
OGC	Open Geospatial Consortium
OWL	W3C Web Ontology Language
PROV	W3C Provenance
RFC	Request for Comments
RDF	Resource Description Framework
RPC	Remote Procedure Call
SME	Small and Medium Enterprises
TC	Technical Committee
TS	Technical Specification
UML	Unified Modeling Language
WMS	OGC Web Map Service
W3C	World Wide Web Consortium

List of tables

1 Introduction

This deliverable describes standardization activities related to Linked Data best practices and geographic information standards that are applicable to the Linked Map subproject of the PlanetData project. Standardization enables the use of recognized methodologies, processes and terminologies that enhance interoperability and compatibility with existing products and services. Also, standardization eases possible impact, long-term dissemination and take-up of project results.

The standards organizations we consider relevant to the Linked Map subproject are Open Geospatial Consortium (OGC), World Wide Web Consortium (W3C), International Organization for Standardization (ISO), and Internet Engineering Task Force (IEFT) because they develop key standards related to Web and geographic information. Standards and best practices adopted for the project are concerned with Web technologies, semantic interoperability and data description, and they have been published by OGC and W3C mostly. The Linked Map subproject can contribute to standardization bodies with insights and experiences in some topics, such as REST geoservices and integration of geoservices with Linked Data.

The standardization activities described in this document encompass:

- The identification of standardization bodies and standards relevant for the Linked Map subproject (section 2).
- The description of the adoption and implementation of standards (section 3).
- The enumeration of activities related to spreading and discussing results with people involved in the elaboration and maintenance of adopted standards (section 4).

Spreading and discussing the adoption of standards and proposing improvements are part of the standardization activities. These activities are complex and require time and commitment by researchers. Linked Map is a short-term project (1 year) within PlanetData. Therefore, standardization activities should continue after the end of the project. Hence, this deliverable describes standardization activities programmed after the end of the project.

2 Relevant bodies and standards

This section introduces international standards organizations that produce standards relevant to the Linked Map project. Each entry includes a description of the standardization procedures of each organization and the standards that we believe relevant to the Linked Map project.

2.1 Open Geospatial Consortium (OGC)

OGC[1] is an industry consortium that defines voluntary consensus standards for all aspects of geospatial information and services. Many OGC standards can be directly implemented. OGC standards are available on a non-discriminatory, royalty free basis. OGC has currently 478 members[2] representing all levels of government, the private sector (including SME), universities, NGOs and the open source community. For example, UNIZAR is a member of OGC as university. OGC work is driven by member and market requirements.

OGC standards work occurs primarily in two major programs: the *Interoperability Program*[3] and the *Standards Program*[4]. The *Interoperability Program* develops numerous initiatives for capturing interoperability requirements and use cases and prototyping applications. The objective is the development of new *candidate standards*, and extensions and change requests to existing OGC standards. The *Standard Program* is the formal consensus process to arrive at standards adopted by OGC. Candidate standards may have been developed outside OGC, developed in an OGC *Standard Working Group*, or submitted by the *Interoperability Program*. The *Standards Program* provides different and specialized open forums for discussion of requirements use cases, issues, implementations, lessons learned, new standards, and extensions and change requests to existing standards.

Below is a list of OGC standardization works that we believe relevant in the Linked Map project:

- *Map standards*. The *OpenGIS® Web Map Service (WMS) Implementation Specification* version 1.3.0 is an interface standard that provides a simple RPC interface for requesting a visual representation of geospatial data using the HTTP protocol. A WMS request defines the geographic content (layers in WMS terminology) and area of interest to be processed (bounding box). The response to the request is a georeferenced map image (returned as JPEG, PNG, etc.) that can be displayed in a browser application. The specification WMS 1.3.0 and the ISO 19128:2005 standard are the same document as a result of OGC and ISO liaison agreement.
- *Query standards*. The *OGC GeoSPARQL – A Geographic Query Language for RDF data* standard supports querying geospatial data on the *Semantic Web*. The term Semantic Web here refers to the vision of W3C of a Web of linked data. GeoSPARQL defines an extension to the W3C SPARQL query language for processing geospatial data, including quantitative processing (e.g. querying for geometries that intersect with a given geometry).
- *Serialization standards*. WKT is a plain text markup language for representing 2D geometries defined in *Simple Feature Access – Part 1: Common Architecture*. WKT is also standardized by ISO in the ISO 19125:2004-1 standard and later extended in the ISO/IEC 13249:2011 standard.
- *Vocabulary standards*. The GeoSPARQL standard also defines a vocabulary for representing geospatial data in W3C RDF, the common model for representing information in the Semantic Web. In addition, GeoSPARQL is designed to enable qualitative spatial reasoning (e.g. querying for resources that assert intersect with a given resource).

[1] http://www.opengeospatial.org/

[2] http://www.opengeospatial.org/ogc (last visited July 19th, 2014)

[3] http://www.opengeospatial.org/ogc/programs/ip

[4] http://www.opengeospatial.org/ogc/programs/spec

2.2 World Wide Web Consortium (W3C)

The World Wide Web Consortium (W3C)[5] develops consensus-based technical specifications and guidelines for the standardization of Web technologies. W3C members are organisations and individuals. W3C has currently 384[6] members. Membership fees vary depending on the annual revenues, type and location of headquarters of an organisation.

W3C standards work often starts when members express interest in a particular topic in the form of *Member Submissions*. When there is enough interest in a topic, W3C organizes a chartered *Working Group*. Working Groups may create *Working Draft* specifications and guidelines that may advance to *Candidate Recommendation* status (W3C believes the specification is sufficient mature for implementation), *Proposed Recommendation* status (W3C seeks wide review for technical soundness and implementability) and finally *W3C Recommendations* status (W3C endorses the document after extensive consensus-building).

W3C is building a technology stack to support a Web of linked data, i.e. the *Semantic Web*. The stack should enable computers to do more useful work with structured data and to develop systems that can support trusted interactions over the Web. Below is a non-exhaustive list of recent standardization works part of the Semantic Web stack that we believe relevant to the Linked Map project:

- *Linked Data standards*. The Semantic Web needs access to data and relationships among data. To achieve and create Linked Data, systems need a common model for representing information (the *Resource Description Framework* (RDF) family of recommendations related to syntax, semantics and serialization), a language for authoring ontologies (the *Web Ontology Language* (OWL) family of recommendations), best practices and simple approaches for implementing a read-write architecture (*Linked Data Platform 1.0* (LDP) recommendation) and a language for expressing customized mappings from relational databases to the common model (*R2RML: RDB to RDF Mapping Language* recommendation).
- *Query standards*. The Web is viewed as a global database in the Semantic Web vision. SPARQL is the query language for that data and the name of the accompanying protocol for sending queries and receiving results through the Web. Note that OGC GeoSPARQL has not been submitted to the W3C standards track at the moment of this writing.
- *Standard vocabularies*. W3C has developed several vocabularies for describing numerous areas of concern using semantic technologies. Among these vocabularies, we believe that the provenance model and corresponding serializations defined in the *Provenance* (PROV) family of recommendations are the most relevant to our project.

2.3 International Organization for Standardization (ISO)

ISO[7] is one of world's largest international standards setting organizations. ISO is composed of representatives from various national standards bodies (e.g. DIN of Germany, AENOR of Spain, BSI in United Kingdom). ISO standards are developed by groups of experts put forward by ISO's members following a project approach within technical committees (TC). Each standardization project usually takes at least 24 months. The development can be fast-tracked under special circumstances.

Each TC deals with a different domain. In particular, ISO/TC 211[8] is the ISO TC responsible for standardization of geospatial information and services. Its work aims at establishing standards that ensure interoperability of information concerning objects that are associated with a location relative to the Earth. ISO/TC 211 has issued semantic, syntactic, service and procedural standards, at various levels of abstraction.

[5] http://www.w3.org/

[6] http://www.w3.org/Consortium/Member/List (last visited July 26th, 2014)

[7] http://www.iso.org/

[8] http://www.isotc211.org/

National standards bodies in turn may have TCs that act as the national counterparts of ISO/TCs. For example, UNIZAR participates in AENOR/TC 148[9] that is the national counterpart of ISO/TC 211.

OGC and ISO/TC 211 have a long history of collaboration. OGC standards have been submitted to ISO/TC 211 for consideration for approval as International Standards. Many OGC standards are based on abstract models defined by ISO or jointly by OGC and ISO.

Below is a list of the ISO standards that we believe relevant to the Linked Map project:

- *Map standards*. The international standard ISO 19128:2005*, Geographic Information – Web Map Server interface* specifies the behaviour of a service that produces spatially referenced maps dynamically from geographic information. ISO 19128:2005 and OGC WMS 1.3.0 are the same document as a result of ISO and OGC liaison agreement.
- *Metadata standards*. The international standard ISO 19115:2003 *Geographic Information – Metadata* specifies the schema required for describing geographic information and services. The metadata schema defined in this standard provides information on the identification, extent, data quality, lineage, etc. of a resource. ISO 19115 is used widely in desktop and web-based GIS and metadata editors. ISO 19115-2:2009 is an extension of ISO 19115:2003 that defines metadata for imagery and gridded data. Lineage information in ISO 19115-2 is far better represented than in ISO 19115. ISO 19115-1:2014 is a revision of ISO 19115:2003 and hence will replace it. The latest revision continues the improvement of the lineage information model.
- *Serialization standards*. The international standard ISO 19125:2004-1 *Geographic Information – Simple feature access – Part 1: Common architecture* establishes a common architecture for accessing geographic information and standardizes OGC WKT. ISO/IEC 13249:2011 *Information technology – Database languages – SQL multimedia and application packages – Part 3: Spatial* defines spatial user-defined types, routines and schemas for generic spatial data handling. It also extends WKT standard by adding support for encoding complex geometries and 3D geometries.

2.4 Internet Engineering Task Force (IETF)

The Internet Engineering Task Force (IETF)[10] is an open standards organization with no formal membership that develops and promotes standards for the Internet (e.g. TCP/IP). The IETF is organized into a large number of chartered working groups and informal discussion groups, each dealing with a specific topic. Work is open to all who want to participate, and holds discussions on open mailing lists. There is no voting procedure as it operates on *rough consensus* process. Therefore, results can be slow when the number of participants is small or so large.

IETF standards work produces *Internet Standards*. An Internet Standard is a special *Request for Comments* (RFC) or set of RFCs. A RFC is a memorandum published by the IETF authored by engineers and computer scientists describing methods, behaviours, research, innovations and specifications applicable to the Internet. Specifications stable, well understood, with significant community review and appearing to be valuable are eligible to move onto to the IETF standards track as *Proposed Standard*. Proposed standards with significant implementation, successful operational experience and high degree of technical maturity may be considered Internet Standards. That is, a specification is considered an Internet Standard when provides a tangible and significant benefit to the Internet community.

The Proposed Standard RFC 5988 *Web Linking* is the most relevant IETF standard in the context of the Linked Map project. RFC 5988 defines a typed connection between two resources (context and target) that are identified by *Internationalised Resource Identifiers* (IRIs). RFC 5988 links can be viewed as a statement of the form *"{context IRI} has a {relation type} at {target IRI} which has {target attributes}*". Web Links can be serialized in HTTP headers in the *Link* entity-header field, in HTML documents in the *Link* element and in ATOM documents in the *atom:link* element.

[9] http://www.aenor.com/aenor/normas/ctn/fichactn.asp?codigonorm=AEN/CTN%20148

[10] http://www.ietf.org/

2.5 Summary

Table 2 presents a classification of the above refered standards grouped by standardization body.

Table 1 – Relevant standards

Kind	OGC	W3C	ISO	IETF
Discovery Standards				Web Linking [1]
Linked Data Standards		RDF [2], LDP [3], OWL [4], R2RML [5]		
Map Standards	WMS [6]		ISO 19128 [7]	
Metadata Standards			ISO 19115 [8], ISO 19115-1 [9], ISO 19115-2 [10]	
Query Standards	GeoSPARQL [11]	SPARQL [12]		
Serialization Standards	WKT [13]		ISO 19125-1 [14], ISO 13249 [15]	
Vocabulary Standards	GeoSPARQL	PROV-O [16]		

3 Adoption of standards in Linked Map

This section details which standards have been adopted in the Linked Map project. Sharing adoption experiences, lessons learned and issues found have driven the standardization activities described in section 4.

3.1 Web standards

The use of Web standards is required in WP17 because one of the goals of the Linked Map project is the development of a semantic wrapper for the OGC WMS standard. This wrapper is named Linked Map Service (LMS) and it is described in the deliverable D17.1 [17].

Below is a list of Web standards used in the Linked Map project:

- *Map standards*. LMS acts as a transparent reverse proxy server for WMS 1.3.0 servers. That is, an LMS instance is able to sit in front of a set of remote WMS servers, to advertise WMS endpoints, to determine the remote server to route a WMS request to those endpoints, and to return the remote response to the requester. Transparency is achieved as follows. If a client asks for WMS service metadata, the request is routed to the corresponding remote WMS endpoint, and then, the response is modified so each endpoint declared in the document returned to the client points to a LMS endpoint. This feature is available since release 0.8.
- *Discovery standards*. LMS advertises the support of the LMS model and the relations of the resources managed by adding specific RFC 5988 HTTP `Link` headers in all responses to requests made to the URI space managed by the LMS instance. This feature is available since release 0.9.

3.2 Semantic standards

Semantic standards are at the core of WP 16 and WP17. WP 16 focuses on the conversion of geographic datasets into Linked Data, the creation of links between these datasets and other Linked Data datasets, and providing ways for querying those datasets. Meanwhile, the LMS prototype developed in WP 17 addresses the interoperability between OGC WMS and Linked Data.

Below is a list of semantic standards used in the Linked Map project:

- *Linked Data standards*. The LMS prototype developed in WP 17 is able to dereference URIs using Linked Data best practices and techniques. Since release 0.8, LMS offers a read only Linked Data interface for data stored in RDF files, Apache Jena-based RDF stores, and SPARQL endpoints. Release 1.0 implements practices and techniques inspired by LDP including updating, creating and deleting some resources. The development of a provisioning mechanism that converts geographic datasets into Linked Data in WP 16 uses the R2RML specification for specifying the transformation of relational data into RDF data. The provisioning mechanism also uses OWL for encoding an extension to the PROV data model.
- *Query standards*. An outcome of WP 16 is a RDF store expressed in GeoSPARQL. The store can be queried through a SPARQL 1.1 endpoint that supports GeoSPARQL. This endpoint is queried by the LMS prototype for resources that may appear in the spatial extent of user requested maps and for descriptions of these resources. LMS 1.0 uses SPARQL Update to create, to update or to delete some resources.
- *Vocabulary standards*. GeoSPARQL is the vocabulary used for the description of resources and its geometries. PROV is the vocabulary used for the description of lineage information. Lineage information includes data source descriptions, date of the download, transformation made, etc.

3.3 Data standards

This subsection presents data standards that are used in the Linked Map project and not related directly with semantic standards. These standards have been mainly used in tasks related to WP 16.

- *Metadata standards*. The lineage model described in the ISO 19115 family of metadata standards is analysed and compared with the PROV model as starting point for the development of an extension to the PROV model.
- *Serialization standards.* GeoSPARQL defines two possible serializations when generating geometry literals. We have chosen the WKT serialization, as it is more concise than the alternative based on a XML grammar.

3.4 Summary

Table 2 groups the standards adopted in the Linked Map project in discovery standards, Linked Data standards, map standards, metadata standards, query standards, serialization standards and vocabulary standards. It also reports the deliverable in which is documented its use.

Table 2 – Adoption of standards

Kind	Standards	Use documented in
Discovery Standards	Web Linking	D17.1 [17]
Linked Data Standards	RDF, LDP, OWL, R2RML	D16.3 [18], D17.1
Map Standards	WMS	D17.1
Metadata Standards	ISO 19115	D16.1 [19]
Query Standards	SPARQL, GeoSPARQL	D16.4 [20]
Serialization Standards	WKT	D16.2, D16.3 [18]
Vocabulary Standards	GeoSPARQL, PROV-O	D16.1, D16.2 [21], D16.3

4 Standardization activities

4.1 Considerations

Standardization activities are complex and commitment activities. Linked Map is a short-term project (1 year) within PlanetData. Therefore, the measurement of the success of the standardization activities should not be performed in this stage. It is necessary to understand that the above described standardization procedures progress very slowly and any standard requires a broad consensus. As a consequence, our standardization activities are focused on spreading and discussing the results and approaches of Linked Map among people involved in standardization activities related to the standards adopted in the project.

We believe that the Linked Map project can contribute insights to the standardization of the following topics:

- *Best practices for future REST geoservices and geosemantic frameworks*. For example, the use of Web Links for making explicit the relation between alternative resources offered by a geoservice. This task has involved dissemination activities in OGC mainly.
- *Novel ways of using Linked Data with legacy systems*. For example, the use of Linked Data for providing a machine-readable description associated with georeferenced images returned by a Web service. This task has involved dissemination activities in OGC and W3C mainly.
- *Integration of spatial information in the Web of data*. For example, the use of PROV for documenting the transformation of relational spatial data into Linked Data. This task has involved dissemination activities in OGC and W3C mainly.

4.2 Activities at OGC

The following activities have been realised at OGC:

- Linked Map activities have been disseminated to OGC members involved in areas related to the project through relevant OGC mailing lists. The OGC Iberian and Latin-American Forum (ILAF) is also included because of the spatial scope of the experiments done in the LMS platform.
- Linked Map experiences have been presented to people involved in the active initiative of the Interoperability Program (OGC Testbed 10[11]). In particular, with people involved in the cross-community interoperability thread (Virtual Globe Gazetteer [22] and Provenance [23]).
- Two change requests [24], [25] regarding the standard OGC Web Services Common Standard [26] and the best practice Semantic annotations in OGC standards [27] have been submitted (details in Appendix I).
- Presentation of the Linked Map project at the GeoSemantics DWG during the 92nd OGC Technical Committee (Calgary, Canada) [28].

4.3 Activities at W3C

The following activities have been realised at W3C:

- Linked Map activities related to provenance have been shared with people involved in the former Provenance Working Group[12] directly or by means of mailing lists.
- Linked Map platform has been disseminated to members of W3C community groups related to GI and geo semantics including cartography[13], places[14], geospatial Semantic Web[15], and, due to the geographic extent of the project, Open Data Spain[16].

[11] http://www.opengeospatial.org/projects/initiatives/ows-10

[12] http://www.w3.org/2011/prov/wiki/Main_Page

4.4 Activities in other bodies

Although ISO 19100 family of standards are the basis for provenance work in the project the only relevant activity is the diffusion of Linked Map activities among members of CTN 148.

Regarding to IETF, RFC 5899 was produced outside of an IETF working group. The experience and issues found have been shared directly with the responsible of RFC 5899 Mark Nottingham.

4.5 Sustainability of standardization efforts

Standardization efforts are sustainable because project participants belonging to UNIZAR are already involved in standardization activities with the aforementioned bodies. Next, standardization efforts related to the Linked Map project for 2015 are presented.

- **OGC**. UNIZAR is a member of OGC. Hence, UNIZAR members will be actively involved in activities of the Standards Program related to the topics of the Linked Map project. In addition, the Interoperability Program is organizing the OGC Testbed 11[17]. The call for participation is planned for October 2014. Use cases will involve different areas of interest related to the project, in particular provenance, query and data optimization, and semantically enabled OGC Web Services. UNIZAR has the intention of participating in the call.
- **W3C**. UNIZAR is not a member of W3C. Participation is constrained by such lack of membership. Activities will be restricted to continue the dissemination among W3C members of Linked Map activities. Also, Linked Map server will be tested against LDP testing framework and feedback received will shape future version of the tool. The level of compliance will be published on LDP lists[18]. The participation in activities related to the future working group Spatial Data on the Web[19] will be considered.
- **ISO**. UNIZAR is member of AENOR and some UNIZAR members are involved in ISO/TC211 standardization work. It is planned to be involved in work related to lineage and use of semantic web technologies.

[13] http://www.w3.org/community/carto/

[14] http://www.w3.org/community/places/

[15] http://www.w3.org/community/geosemweb/

[16] http://www.w3.org/community/opendataspain/

[17] http://www.opengeospatial.org/pressroom/pressreleases/2068

[18] http://lists.w3.org/Archives/Public/public-ldp/

[19] http://www.w3.org/2014/05/geo-charter

5 Conclusions

This report demonstrates that standardization work in the project has been two fold: adopting standards and disseminating experiences. There are several relevant bodies and initiatives involved in standardization of GI and its services directly or indirectly now (OGC, W3C, ISO, IETF). The project has adopted several mature (map, metadata and serialization standards) and emerging standards (Linked Data, vocabulary, query and discovery standards). The experience and lessons learned with each standard have been detailed in different deliverables of WP 16 and WP 17. As expected, emerging standards lacks of sufficient support and sometimes have required the development of experimental software for implementing them.

It is quite evident that the standardization works of the most relevant standardization bodies, the transversal W3C and the vertical OGC, presents overlaps. This implies that an effective spreading of Linked Map outcomes requires duplication and coordination of standardization work. In addition, Linked Map is a short-term project (1 year) within PlanetData. Therefore, the measurement of the degree of successfulness of the dissemination of results among standardization bodies should be performed after the ending of the project due to their slow pace. Nevertheless, the report enumerates different contributions to standardization work in OGC and W3C.

Appendix I OGC change requests

I.1 Recommend implicitly the use of the HTTP header Link defined in RFC 5899 (OGC change request 363)

Submitted	2014-08-07
OGC ID	14-098
OGC URL	https://portal.opengeospatial.org/files/?artifact_id=60567
Spec	Web Service Common Implementation Specification [26]
Spec version	2.0.0
Doc Num	06-121r9
Title	Recommend implicitly the use of the HTTP header Link defined in RFC 5899
Reason for change	Linking is at the core of the Web. OGC should provide a solution for data linking valid for REST-based services, but, at the same time, backward compatible with KVP and SOAP services. The use of the HTTP header Link defined in RFC 5899 is a transparent solution for embedding links in HTTP response headers that is transparent at the application level and thus backward compatible. In addition, the support of RFC 5899 by search engines such as Google for indexing the preferred version of a resource offers an opportunity for easing the discoverability of OWS services (KVP, SOAP, REST) in search engines.
Summary of change	Add to 11.7.3 HTTP Response body, at the end of the paragraph that starts with "*Response object should be accompanied by other HTTP entity headers as appropriate and to the extent possible*" the following sentence: "*Link headers defined in IETF RFC 5899 may be used for indicating clients that the requested entity or context has a defined relation with a resource at a target location declared in the header. A list of link relation types is maintained by IANA. For example, the relation type 'canonical' designates the preferred version of a resource. The service may use 'canonical' for linking to a human description of the entity in HTML.*"
Consequences if no approved	I identify two consequences. If this change is no approved, OGC will keep OWS as hidden web objects. As is, this change and implicit recommendation for the use of 'canonical' will ease the discoverability in search engines such as Google. Since 2011, Google supports the use Link headers for determining the URL you want people to see when index a resource[20]. For example, this enables to tell bots that are indexing OWS GetCapabilites requests that you prefer people reach to the service metadata via an URL like that returns a human readable response http://catalog.data.gov/dataset/plss-wms/resource/1bc8d80e-6124-4166-9bb0-581ce71f2c6d rather than URL crawled originally that returns a XML (machine readable) document: http://www.geocommunicator.gov/ArcGIS/services/PLSS/MapServer/WMSServer?service=WMS&request=GetCapabilities In addition, if this change is no approved, OGC will not foster research in web link usage. The use of Web Links with OWS is seldom documented in literature. Schade [29] proposes its use for linking OWS with ISO metadata records. Lopez-Pellicer [30] proposes its use for linking OWS with alternate representations in RDF.

[20] https://support.google.com/webmasters/answer/139066?rd=1

Clauses affected	11.7.3

I.2 RFC 5899 as alternative for a unique annotation element in OGC core schemas in some scenarios (OGC change request 364)

Submitted	2014-08-11
OGC ID	14-090
OGC URL	https://portal.opengeospatial.org/files/?artifact_id=60341
Spec	Semantic annotations in OGC standards [31]
Spec version	2.0
Doc Num	08-167r2
Title	RFC 5899 as alternative for a unique annotation element in OGC core schemas in some scenarios
Reason for change	RFC 5899 offers a standard and harmonized way to annotate semantically resources in some scenarios without requiring the modification of existing OGC core schemas because it operates at the protocol level. RFC 5899 enables two cases for the implementation of semantic annotations in exchanged messages: annotations in entity headers (Link headers) and annotation in entity bodies (several ways). The main difference is that Link headers are annotations about the whole resource that the exchanged message is about (e.g. WFS Service metadata, data model encoded in XML schema, result set encoded in the format predefined by a data schema). The best practices document describes semantic annotations in entity bodies but does not deal with annotations in entity headers. Changes should address how and when should be added these annotations at the protocol level (KVP, XML, REST and SOAP).
Summary of change	The document should address that today here are two scenarios for the implementation of semantic annotations in exchanged messages: annotation in entity headers and annotation in entity bodies. The current discussion about the semantic annotations at three different levels is only focused on annotation in entity bodies. It should be extended, probably by adding a first section presenting the two scenarios for the technical realization of semantic annotations. The section should introduce RFC 5899 and explain that link headers provide typed relations with resources identified by URIs. For example, a same-as relation shall mean that the remote URI is identifies the same resource and that it can be dereferenced to a machine processable description of the resource, and, a described-by relation shall mean that the remote URI is a metadata record providing additional information about this resource. Finally, the discussion for existing GIS standards should add a section discussing how Link headers annotations such be used depending on the protocol used for OWS requests (KVP, XML, REST and SOAP). Appendixes should be updated accordingly.
Consequences if no approved	Without OGC guidance, for example, developers of REST-based geoapplications may use link relations only for describing the semantics of transitions in the system.
Clauses affected	Normative References, Section 2, Section 3, Appendixes
Comments	The use of this kind of links is seldom documented in literature. [29] proposes its use for linking OWS with ISO metadata records. [30] proposes its use for linking OWS with alternate representations in RDF.

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